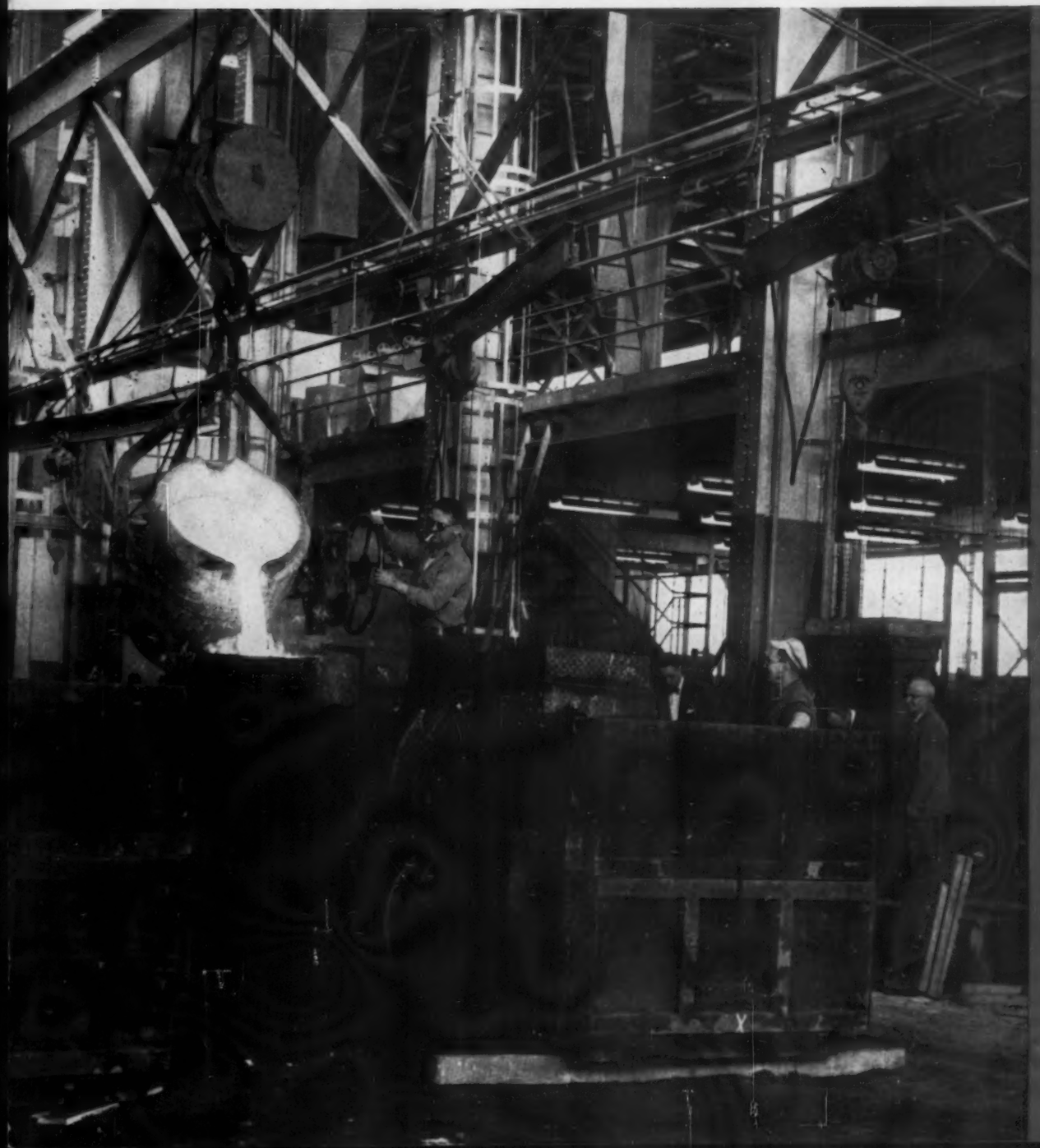
SEPTEMBER, 1956

modern castings



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THE MEN WHO BUY

FIGHTING AIR POLLUTION

16-page special bonus section describes foundry air pollution problem and how to lick it.

Save 5% of Labor Costs
A simple job analysis technique guarantees more efficient plants

Key to Smoother Castings
Surface flowability, short mulling time are important, study shows

Diaphragm Molding
Illustrated article shows methods and principles of this technique

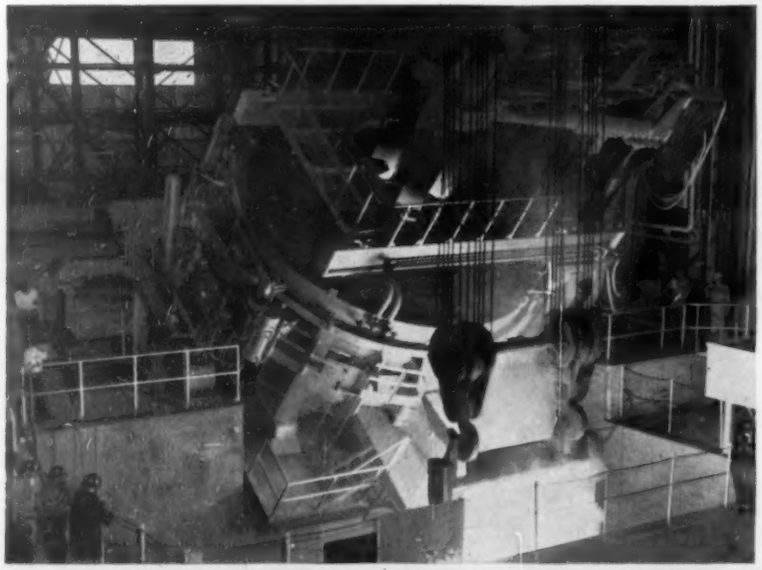
Test Bar Shell Mold
New design fills long felt need for light alloy tensile test bar

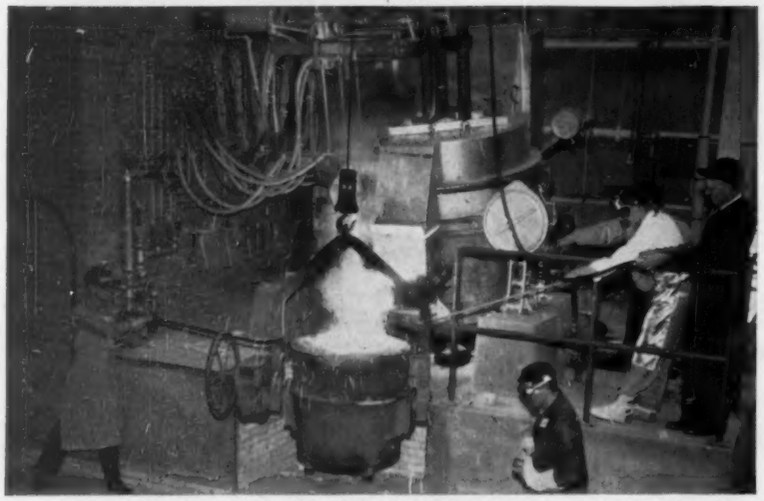
A $7 Million Foundry
New Bullard plant in Bridgeport, Conn., shows new developments

evolutionary

is the word that best describes

LECTROMELT* FURNACES





● Lectromelt's revolutionary announcements were made years ago, when these developments were first introduced by Lectromelt to the metallurgical industry:

Top charging for smooth, fast turnaround in electric furnace operation. There's less downtime between heats and less heat loss. Linings and the electrodes last longer.

Power input boosted tremendously, doubling the day's output. Lectromelt construction was heavied up, larger transformers and leads provided, more efficient cooling added.

Micro-accurate electrode control was combined with counterbalanced arms, greatly increasing the exactness to which analyses could be held. Supervisory labor was thus made much less burdensome.

Why label as revolutionary the things that have long been standard on Lectromelt Furnaces? The same bold thinking—evolutionary thinking—has been constantly applied to Lectromelt Furnaces and Equipment to maintain the leadership established many years ago.

Catalog 9-B describes Lectromelt Furnaces. For a copy, write Lectromelt Furnace Company, 316 32nd Street, Pittsburgh 30, Pennsylvania (a McGraw Electric Company Division).

On research and on production, Lectromelt Furnaces provide the precision of control so necessary to the steelmaker.

Manufactured in . . . ENGLAND: Birlec, Ltd., Birmingham . . . FRANCE: Stein et Roubaix, Paris . . . BELGIUM: S. A. Belge Stein et Roubaix, Bressoux-Liege . . . SPAIN: General Electrica Espanola, Bilbao . . . ITALY: Forni Stein, Genoa . . . JAPAN: Daido Steel Co., Ltd., Nagoya

*REG. T. M. U. S. PAT. OFF

MOORE RAPID

WHEN YOU MELT... *Lectromelt*

CIRCLE NO. 121, PAGE 13-14

future meetings and exhibits

SEPTEMBER

1-9 . . International Foundry Trades Fair and 23rd International Foundry Congress, *Dusseldorf, Germany. Hosts: Association of German Foundrymen, Industrial Association of the Foundry Industry, Foundry Machinery Trade Association, and Joint Association of German Metal Foundries.*

9-12 . . National Metal Trades Association, *Essex-Sussex Hotel, Spring Lake, N. J. Eastern Plant Management Conference.*

11-13 . . American Die Casting Institute, *Edgewater Beach Hotel, Chicago. Annual Meeting.*

16-21 . . American Chemical Society, *Convention Hall, Atlantic City, N.J. Annual Meeting.*

16-22 . . American Society for Testing Materials, *Hotel Statler, Los Angeles. Pacific Area National Meeting and Apparatus Exhibit.*

17-21 . . Instrument Society of America, *New York Coliseum, New York. 11th Annual Instrument-Automation Conference & Exhibit.*

24-25 . . Steel Founders' Society of America, *The Greenbrier, White Sulphur Springs, W. Va. Fall Meeting.*

25-28 . . Association of Iron and Steel Engineers, *Public Auditorium, Cleveland. Iron and Steel Exposition.*

27-29 . . National Association of Foremen, *Jefferson Hotel, St. Louis. Annual Meeting.*

OCTOBER

4-5 . . Magnesium Association, *Drake Hotel, Chicago, Annual Convention.*

6-12 . . American Society for Metals, *Public Auditorium, Cleveland. National Metals Congress & Exposition.*

8-12 . . American Welding Society, *Hotel Cleveland, Cleveland. Fall Technical Meeting.*

10-11 . . Material Handling Institute, Inc., *Traymore Hotel, Atlantic City, N. J. Fall Meeting.*

11-12 . . National Foundry Association, *Sheraton-Cadillac Hotel, Detroit. Annual Meeting.*

11-12 . . Armour Research Foundation, Illinois Institute of Technology, *Hotel*

Sherman, Chicago. National Noise Abatement Symposium.

13 . . Metropolitan Brass Founders' Assn., *The Brass Rail, New York. Forty-sixth Anniversary.*

18-20 . . Foundry Equipment Manufacturers' Association, *The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.*

19-20 . . New England Regional Foundry Conference, *Massachusetts Institute of Technology, Cambridge, Mass. Sponsored by the New England and Connecticut Chapters of the American Foundrymen's Society.*

19-20 . . Northwest Regional Foundry Conference, *Benjamin Franklin Hotel, Seattle. Sponsored by the Washington, Oregon, and British Columbia Chapters and the Oregon State College Student Chapter of the American Foundrymen's Society.*

20-23 . . Conveyor Equipment Manufacturer's Association, *The Greenbrier, White Sulphur Springs, W. Va. Annual Meeting.*

22-26 . . National Safety Council, *Conrad Hilton, Congress, Morrison, and LaSalle Hotels, Chicago. Safety Congress & Exposition.*

25-26 . . Metals Casting Conference, *Purdue University, Lafayette, Ind. Sponsored by the Central Indiana and Michigan Chapters and the Purdue University Student Chapter of the American Foundrymen's Society.*

29-30 . . Refractories Institute, *The Homestead, Hot Springs, Va. Fall Meeting.*

31-Nov. 2 . . Gray Iron Founders' Society, *The Homestead, Hot Springs, Va. Annual Meeting.*

31-Nov. 2 . . Industrial Management Society, *Hotel Sherman, Chicago. Time and Motion Study and Management Clinic.*

NOVEMBER

7-9 . . Steel Founders' Society of America, *Carter Hotel, Cleveland. Technical & Operating Conference.*

8-9 . . All-Canadian Foundry Conference, *Mount Royal Hotel, Montreal, Que. Sponsored by Eastern Canada and Ontario Chapters of the American Foundrymen's Society.*

25-30 . . American Society of Mechanical Engineers, *Hotel Statler, New York. Annual Meeting.*

26-30 . . Third International Automation Exposition, *Trade Show Bldg., New York.*

29-30 . . Michigan Regional Foundry Conference, *University of Michigan, Union Bldg., Ann Arbor, Mich. Sponsored by the Detroit, Saginaw Valley, Central Michigan, and Western Michigan Chapters of the American Foundrymen's Society, and the University of Michigan*

FEDERAL

GREEN BOND

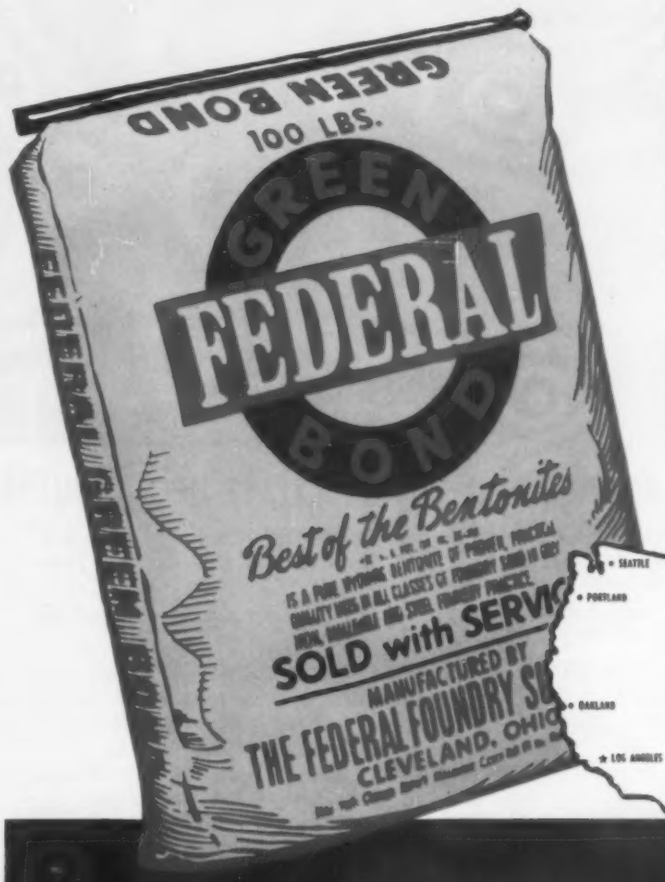
...THE ONLY BENTONITE WITH "NATURAL" LOW VISCOSITY

Low viscosity is a *natural characteristic* of the bentonite clay from which FEDERAL GREEN BOND is produced — *not* a property acquired through adding certain chemicals. FEDERAL engineers "test-drill" bentonite deposits *before* mining — select only those lots with a *natural low viscosity* for production of FEDERAL GREEN BOND.

FEDERAL GREEN BOND is a pure mineral product—*unadulterated, untreated.* It contains no chemicals or other ingredients detrimental to foundry sands or conditions. Its low viscosity, its ability to develop and control HIGH green and dry bond strength, its exceptionally high Ph rating (9.0) and its unerring uniformity are inherent qualities that just "come naturally" in FEDERAL GREEN BOND.

Therefore, if you want to use a bentonite that *just naturally* lets you temper your sand with lower moisture content, develop optimum strength and *save mulling time*—change to FEDERAL GREEN BOND. If you use bentonite in slurry form and want to add up to 25% *more bentonite per gallon of water* for a more potent slurry, thus enabling you to provide better control of moisture content and sand strength—change to FEDERAL GREEN BOND, the best of the bentonites.

FEDERAL GREEN BOND is available in either pulverized, granular or the *quick dispersing* slurry grade—at 18 convenient distribution centers throughout the U.S.A. (see map below). Also available throughout Continental Europe.



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THE FEDERAL FOUNDRY SUPPLY CO.

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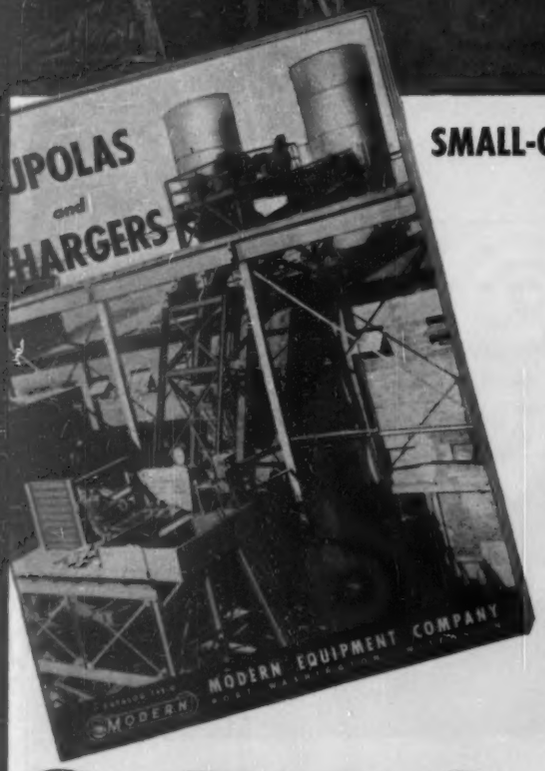
CIRCLE NO. 122, PAGE 13-14



SMALL-CONE ORANGE-PEEL BUCKET CYCLES IN 3 MINUTES

At the Florence Pipe Foundry & Machine Company, Florence, New Jersey, the hourly flow of sand-spun, cast iron pipe now is 35 tons:

- Magnet-crane charges the pig directly into scale-mounted weigh hopper . . .
- Crane carries the coke and stone from cars to bins . . .
- Coke passes over the vibrating screens and is fed to the coke belt by syntron feeder. Stone, too, is belt-fed to coke and stone weigh hopper . . .
- Components, weighed automatically, are recorded on tape in the scale head . . .
- Stock-line indicators control stock level in cupolas . . .
- Settling tank, beneath the bins, receives the cupola slag which is removed by slat conveyor . . .

This and many other AUTOMIZED installations for foundries large and small are described in the new, 36 page, cupola-charger catalog as offered here. Use the coupon or your foundry letterhead . .

MODERN EQUIPMENT CO., Dept. MC-9, Port Washington, W

☐ Mail new catalog on cupolas and chargers, 147-C.
☐ Mail catalog on ladles and pouring devices, P-152-A.
☐ Ask a representative to call.

COMPANY .....
STREET .....ZONE .....BOX .....
CITY .....STATE .....
MY NAME .....

MEMBER FEMA

MODERN

and Michigan State University Student Chapters.

DECEMBER

5-7 . . American Institute of Mining and Metallurgical Engineers, *Morrison Hotel, Chicago. Electric Furnace Steel Conference.*

10-11 . . Material Handling Institute, Inc., *Biltmore Hotel, New York. Annual Meeting.*

1957

FEBRUARY

14-15 . . Wisconsin Regional Conference, *Hotel Schroeder, Milwaukee. Sponsored by the Wisconsin Chapter and the University of Wisconsin Student Chapter of the American Foundrymen's Society.*

21-22 . . Southeastern Regional Foundry Conference, *Dinkler-Tutwiler Hotel, Birmingham, Ala. Sponsored by the Birmingham and Tennessee Chapters and the University of Alabama Student Chapter of the American Foundrymen's Society.*

MARCH

15-16 . . California Regional Foundry Conference, *Claremont Hotel, Berkeley, Calif. Sponsored by the Northern California and Southern California Chapters of the American Foundrymen's Society.*

25-29 . . American Society for Metals, *Pan-Pacific Auditorium, Los Angeles. Tenth Western Metal Exposition and Congress.*

APRIL

12-13 . . East Coast Regional Foundry Conference, *Benjamin Franklin Hotel, Philadelphia. Sponsored by the Philadelphia, Metropolitan and Chesapeake Chapters of the American Foundrymen's Society.*

MAY

6-10 . . American Foundrymen's Society, *Cincinnati. Castings Congress.*

JUNE

20-22 . . Penn State Regional Foundry Conference, *Penn State University, State University, Pa. Sponsored by the Rochester, Pittsburgh, Metrolpolitan, Eastern New York, Western New York, Northwestern Pennsylvania, Central New York, Chesapeake and Philadelphia Chapters and the Penn State University Student Chapter of the American Foundrymen's Society and the Reading Foundrymen's Assn. and Conestoga Foundrymen's Assn.*

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september, 1956
vol. 30, no. 3

modern castings

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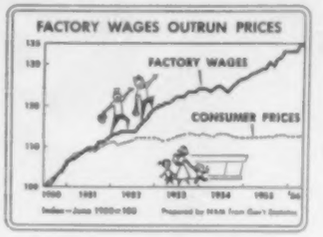
AUDITED PAID CIRCULATION ABC

Something for the Future

There's been a lot of discussion about how much *real* wages have been increased during recent years. The Midwest Division of the National Association of Manufacturers says that since the Korean outbreak the percentage gain in hourly pay is 2½ times the gain in consumer prices.



In other words, for every dollar increase in the cost of living, wages went up $2.67.

This highlights problems that foundry management is going to have to give increasing attention to installation of labor-saving machinery and the proper training of labor to run the plant efficiently.

Economists predict that by 1965 industry will have to produce 40 per cent more goods with a labor force only 14 per cent larger. A third to a half of these will have to be highly skilled.

Time to plan for this is now—both in informal on-the-job training and in weekly classroom instruction on company time, says the National Foundry Association.

Other methods urged by NFA include "(1) the upgrading of existing semi-skilled personnel to make them skilled; (2) recruiting skilled workers and, (3) holding onto skilled personnel by keeping competitive on wages and benefits, by offering some overtime, by promoting from within, and by improving your plant conditions."

One of the things foundry management should watch more carefully is transportation costs. Dr. John R. Frederick of the University of Maryland says that transportation generally is the largest single cost item left in the area of controllable costs today. On the average, transportation takes 27 cents out of every sales dollar. A new book by Dr. Frederick, "Traffic Department Organization," will be published by Chilton this month.

Allegheny Ludlum Steel Corporation has come up with new competition for the castings industry in the form of hot extruded tool and high speed steel shapes. William B. Pierce, vice-president, says the company is ready to extrude an infinite variety of shapes in these tough materials. The process could also affect rolling and forging industries. The company expects designers to take advantage of new tool shapes designed to their own cross-section requirements. Limitations are a minimum size of one-half sq. in. cross-sectional area and a maximum size of a section that can be inscribed in a 4-in. diameter circle. Maximum product length is 40 ft for unannealed and 12 ft for annealed.

modern castings album

1957 AFS Castings Congress and the first Engineered Castings Show will be held in the Cincinnati Music Hall, above, activity center for this city on the fabled Ohio River. Cincinnati's success in making the switch from river port to industrial metropolis has resulted in its position as the world leader in the production of machine tools.

The discoverer of Carborundum, electric-furnace graphite, and of colloidal dispersions, Dr. Edward Acheson, was honored by this special exhibit at the Henry Ford Museum honoring his centennial. Featured in the display are facsimiles of important patents and personal papers, as well as examples of his works. Howard A. Acheson, president of Acheson Industries, is shown before the bronze bust of his father.

Portable air and high frequency electric tools ride right up to the customer's foundry for demonstration in this Buckeye Tools Traveling Clinic. The unit includes a specially-designed station wagon, carries its own air and electric power and can be set up for full operation in minutes. A large working area at the rear of the trailer permits actual job demonstrations of abrasive and drilling tools.

GIRI elects officers

R. R. Washburn, Plainville Casting Company, was elected president of Gray Iron Research Institute, Inc., at its annual meeting in Cleveland. Other officers are: *vice-president,* J. L. Brooks, Sparta Div., Muskegon Piston Ring Co.; *secretary,* H. W. Ruf, Grede Foundries, Inc.; *treasurer,* T. W. Curry, Lynchburg Foundry Co.

Members of the executive committee include Mr. Washburn. Mr. Brooks, W. L. Seelbach, Superior Foundry, Inc.; E. L. Roth, Motor Castings Co.; F. J. Sherwin, Chicago Hardware Foundry Co.; and S. H. Bullard, The Bullard Co. S. C. Clow of James B. Clow and Sons, was appointed chairman of the Research Steering Committee.

Looking into the Cupola

What's going on in the cupola or furnace at any given time? Television can give the answer.

A furnace-scanning periscope has already been installed at the Barking Power Station near London, England, and it is coupled with a close-circuit television viewer.

The periscope is watercooled, with air-blast incorporated to keep fly ash from settling on the lens windows. It is mounted on a carriage which can be advanced into the furnace or retracted by a remote-controlled air cylinder.

A photo-electric cell sounds an alarm if furnace brightness is reduced below normal and the periscope is automatically advanced. Then the operator observes on the TV screen what's going on.

DELTA
DRI-BOND BINDER
DEVELOPS
1. HIGHER TENSILE AND COMPRESSION STRENGTH...
2. GREATER WATERPROOFING PROPERTIES...
3. HIGHER GREEN STRENGTH AND HOT STRENGTH
IN CORE SAND
THAN ANY OTHER DRY BINDER TESTED

DELTA DRI-BOND BINDER is a product of several years of research and experimentation in our own sand research laboratory and proved by additional years of actual experience-in-use data compiled by prominent foundries. The excellent results obtained with Delta Dri-Bond Binder, reported by all sources, establish beyond question both the outstanding superiority and greater economy of this new product for use in steel, gray iron and non-ferrous foundries.

Cores made with Delta Dri-Bond Binder have excellent resistance to metal erosion, completely resist veining and metal penetration and shake out readily from the finished castings.

Get the Facts . . . Working samples and complete literature on Delta Dri-Bond Binder will be sent to you on request for test purposes in your own foundry.

DELTA

DELTA OIL PRODUCTS CO.
MANUFACTURERS OF SCIENTIFICALLY CONTROLLED FOUNDRY PRODUCTS

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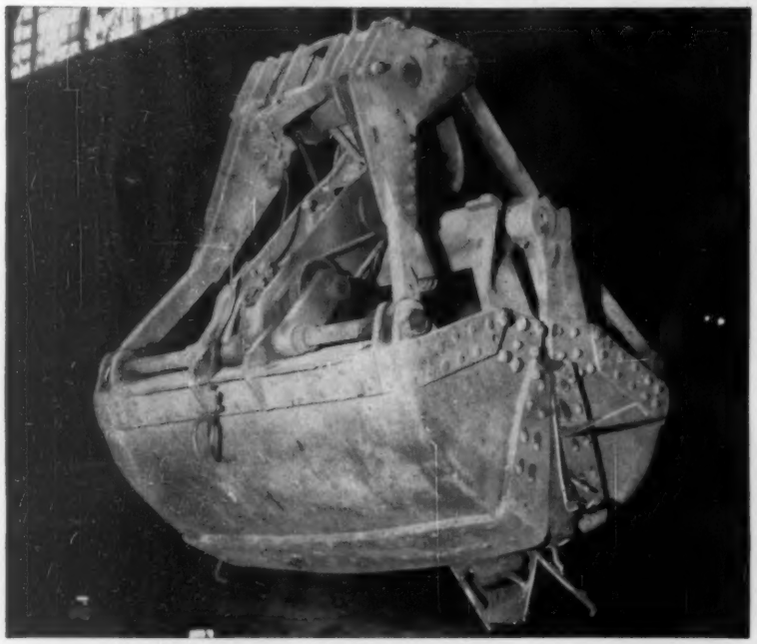
CIRCLE NO. 124, PAGE 13-14

GOOD SERVICE FOR 10 YEARS
FROM OUR
ERIE HOOK-ON BUCKETS



● **STATES W. R. HODDER .... UNITED ENGINEERING AND FOUNDRY CO.**

Ten years ago, United Engineering and Foundry Co. purchased an ERIE Single-Line, Hook-On Bucket. Their requirements were tough, but fair. They needed a durable, smooth-working clamshell to handle slag—a bucket fully controlled by their crane operator, from his cab.

United Foundry now has four ERIE Hook-On's at their Pittsburgh and Vandergrift, Pa. plants. Bucket No. 1 has required little maintenance, still gives fast operation and full payloads. Their other ERIE buckets are doing fine, too. Looking at the record, W. R. Hodder, Chief Plant Engineer, reports: "Our experience with ERIE buckets has been very satisfactory."

Check the ERIE—feature for feature—against any other hook-on clamshell made!

Plus Features of ERIE Buckets

1. Hooks up and is in operation in less than five minutes. Detaches just as quickly.
2. Extra heavy, balanced clams for equal crowding on both closing edges at all times.
3. Narrow, rigid, one-piece welded head shrugs off jars, eliminates wobble, minimizes maintenance.
4. Lever arm and block and tackle design provides great closing power for full payloads.

Write for Catalogs, Dept. M96

ERIE BUCKETS THE WORLD OVER

ERIE STRAYER CO.

1096 GEIST ROAD • ERIE, PENNSYLVANIA

CIRCLE NO. 125, PAGE 13-14

products and processes

Oxy-acetylene pressure regulators designed for small shops, known as 8000 series. Two-gauge type measures 4½x4½, weighs 2¼ lb. Single style measures 3½x5½, weighs 2 lb 1 oz. *Air Reduction Company, Inc.*
CIRCLE NO. 1, PAGE 13-14

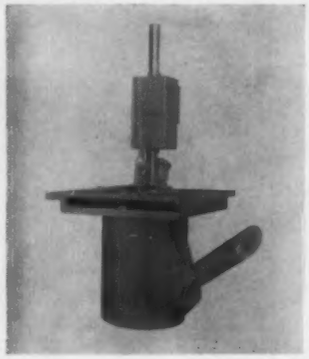
Dye penetrant in pressured can available in kit. Spotcheck allows easy checking of cracks, seams, porosity and other defects open to surface in almost any solid material. *Magnaflux Corporation.*
CIRCLE NO. 2, PAGE 13-14

Neutralene gas producers for generating purified exothermic gas used to create protective atmosphere for heat treating. *General Electric.*
CIRCLE NO. 3, PAGE 13-14

Heat-resistant suit used in 1200 deg. oven. Qualities due to heat protective ability of aluminum-coated fabric which reflects radiant heat. *Minnesota Mining & Mfg. Co.*
CIRCLE NO. 4, PAGE 13-14

Thermistor bolometer, called Servotherm, for infrared radiation detector from 1-12 microns. Used where direct contact not possible. *Servo Corporation of America.*
CIRCLE NO. 5, PAGE 13-14

Automatic ladling unit of aluminum. Basic pump has no moving parts.



Adaptable to electric or fuel fired reverberatory furnaces. Handles one to 10 lb aluminum. Molten metal does not contact any metal structure. *Lindberg Engineering Co.*
CIRCLE NO. 6, PAGE 13-14

Portable lifts, propelled by one man, hand or battery-operated with capacity to 2000 lb. May be used as platform truck, straddle fork, elevator or crane. Built-in chargers. *The Oster Manufacturing Co.*
CIRCLE NO. 7, PAGE 13-14

Low porosity ceramic strainer core developed for use with high manganese bronze. Known as K-148 it is said to have helped in reducing reject loss. *Universal Clay Products Co.*
CIRCLE NO. 8, PAGE 13-14

Gun-shot mix for patching gray iron cupolas. Consists of "Firestone" coated with refractory fire clay in pelletized form. *Silica Chemicals, Inc.*
CIRCLE NO. 9, PAGE 13-14

Skin protection in five oz aerosol bomb. Spray, called "G-63 Burn & Relief Spray" is said to relieve secondary infection. Industrial use would

be for heat, acid or chemical burns. Also has home uses. *General Scientific Equipment Co.*

CIRCLE NO. 10, PAGE 13-14

Angle finder and point indicator, "Miracle Point Indicator", consists of mercury-balanced level, degree-cali-

brated dial, mounted on magnetized V-base. Said to be accurate within three min. of deg. *Racine Instrument Co.*

CIRCLE NO. 11, PAGE 13-14

Scanning spectrometer, grating type. Built-in eight-speed motor gives variable speed scanning, also has manual drive. Available in two electronic systems for either direct recording of spectral intensities or absorption studies. *Jarrell-Ash Co.*

CIRCLE NO. 12, PAGE 13-14

Epoxy resin kit for use in field repairing of epoxy castings, laminated plastics and industrial products, comes in 2 tubes in pre-proportioned

and pre-weighed amounts of resin and hardener. For correct amount simply match the lengths. *Houghton Laboratories, Inc.*

CIRCLE NO. 13, PAGE 13-14

High capacity switch to handle in-rush currents to 75 amps, model BAF-2RQN8. Actuator is field adjust-

Growing Sales of

WOODWARD PIG IRON

Attest Its Quality and Uniformity

So favorable has been the reception given uniform Woodward iron by the nation's foundry trade in recent years that Woodward has increased its production capacity approximately 45% since 1950. It has likewise invested more than $14 million to improve its facilities and better its service to customers.

While conditions of the market have been a factor in Woodward's mounting sales, a major cause has been the widespread recognition of the foundry trade that Woodward consistently produces only uniform quality iron in accordance with a standard that is rigorously upheld.

When your Company is in the market for quality iron—foundry or malleable grades—Woodward would like to serve you.

For quotations, write or call our Sales Department, Woodward, Ala.
Phone Bessemer, Ala. 5-2491
or Sales Agents for territory north of Ohio River:
HICKMAN, WILLIAMS & COMPANY with Sales Branches at–

609 Bona Allen Building, Atlanta 3, Ga.; 230 North Michigan Avenue, Chicago 1, Ill.; First National Building, P. O. Box 538, Cincinnati 1, Ohio; 1659 Union Commerce Building, Cleveland 14, Ohio; 1203 Ford Bldg., Detroit 26, Mich.; P. O. Box 335, Duluth 1, Minn.; 412 Guaranty Bldg., Indianapolis 4, Ind.; 70 Pine St., New York 5, N. Y.; 1500 Walnut Street Bldg., Philadelphia 2, Pa.; 1910 Clark Bldg., Pittsburgh 22, Pa.; 902 Syndicate Trust Bldg., St. Louis 1, Mo.

Woodward Iron Company

WOODWARD, ALABAMA

Independent Since 1882

WOODWARD IRON COMPANY

CIRCLE NO. 126, PAGE 13-14

DEPENDABLE QUALITY

When it comes to quality in abrasives—*dependable quality*, that is—Metal Blast's SUPER-ANNEALSHOT is the one abrasive that's really pointed out! It's the finest malleableized abrasive that modern production methods ever developed. We use the best of raw materials, heat treated in automatic, scientifically-controlled furnaces. And we make a good deal of this good shot and grit, for a lot of good customers—so that mass production keeps prices low. When you're ready to buy—give SUPER-ANNEALSHOT a try. You'll be glad you did!

METAL BLAST, INC.

872 EAST 67th STREET • CLEVELAND 3, OHIO

PRODUCING THE FINEST CHILLED AND MALLEABLE SHOT AND GRIT ON THE MARKET

CIRCLE NO. 127, PAGE 13-14

able through 360 deg, can be positioned left or right. *Micro Switch Div., Minneapolis Honeywell.*

CIRCLE NO. 14, PAGE 13-14

Blast room features one moving part, the exhaust impeller. Superior efficiency claimed due to downdraft

flow of air through maze. May be placed directly on floor. No pit required. *Vacu-Blast Co., Inc.*

CIRCLE NO. 15, PAGE 13-14

Non-indicating controllers, potentiometer type for use in batch process work. 150 series has contact rating of 6 amps at 115 v ac, 3 amps at 230 v ac. Series weighs 7 lb. Circuit said to be "fail safe". *Barber-Colman Co. Wheelco Instrument Div.*

CARCLE NO. 16, PAGE 13-14

Aluminum barrel truck, "Ezy-Rol," equipped with two-wheel safety brakes. Said to give driver control of

1000-lb load. Special loading shoes give easy tipping, allow for short handles, easier turning. *Valley Craft Products, Inc.*

CIRCLE NO. 17, PAGE 13-14

High vacuum pumping system, portable. Has fractionating 4-in diffusion pump, connected to 15 cfm two-stage roughing and backing mechan-

ical vacuum pump. Recommended for exhausting 10-15 cu ft chambers. *New York Air Brake Co.*

CIRCLE NO. 18, PAGE 13-14

Hole former for barrels, pressure on handle cuts clean hole in steel bar-

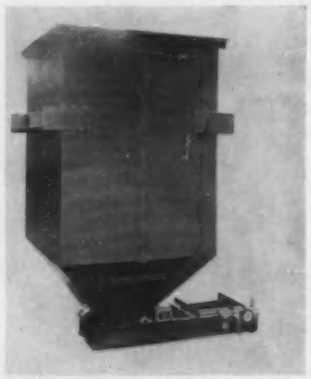
rels for chain hoist hooks. "Barrel Buddy" has forged steel cutting head. *Huron Steel Treating Co.*

CIRCLE NO. 19, PAGE 13-14

Profiler, contour grinder powered by 2-hp remote-controlled motor. Wheel can be tilted 0- 5 deg by hand wheel, and raised from table level to 10 in. Dimensions, 32 in. wide, 37 in. deep and 76 in. high. *Kindt-Collins Co.*

CIRCLE NO. 20, PAGE 13-14

Suspension hopper scale. Cumulative weighing from series of feeders or feeders of single hopper. Seven mod-



els, 33-200 cu ft, capacities to 6,000 lb. Available with air-operated gates or manual handwheel. *Richardson Scale Co.*

CIRCLE NO. 21, PAGE 13-14

Pneumatic muffler "4-44 Atomuffler" for use on air-operated equipment. Said to muffle without restricting normal air flow by dispersing outward

Teeth that hold like a bear-cat

...or how Chuck Wright raised stamina in large gears

"First, a large grinding mill gear brought a complaint from the customer. The next week another large gear, one cast to drive a pebble mill, caused a beef. Soon after, another customer complained about a big blower gear that galled. Naturally, Knox Foundry recognized a problem, and wired for help," explained Chuck.

"All three castings lacked wear resistance. On blower and pebble mill gears, teeth broke in service.

"These failures stymied Angus Bryden and the boys at Knox. They'd been pouring gears for a long time . . . not as large . . . but results were tops with a NCI 40 alloy iron.

"Moulding, sand, risering . . . the Knox practice was OK . . . and in view of their prior success with iron of about 3.30 carbon, 2.00 silicon plus a little alloy, they couldn't see why these castings failed.

"In large gears, the teeth are critical sections. But, as I explained to Angus, the thickness of the rim is the section determining the properties. For rims 4" thick in which teeth are cut, I suggested an addition of 2½ to 3% nickel plus .5 to .6% moly, with carbon adjusted down to 3.00% and silicon down to about 1.75% to compensate for the heavier rim sections. Also showed how structure control improves wear properties.

"This composition would give a minimum tensile of 50,000 in a 2" bar . . . and also higher machinable hardness, greater wear resistance and impact strength.

"I showed Angus this bar chart of galling resistance, so he'd aim for the right structure. And a good aim he had!

"Today, the Knox crowd is very happy with the results they get.

"When it's a battle to furnish what the customer wants, don't lose out on a metallurgical TKO. Call me in. Maybe I can help. Easiest way to reach me is through INCO."

Galling Resistance
(From compressive stress-load curves)

Specimen Load (lbs.)	100	200	300	400
Gray Iron				
(dendritic structure)	■	■		
(some ferrite)	■	■	■	
(controlled structure)	■	■	■	■

Chuck Wright

INCO TRADE MARK

The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

*Trademark of The International Nickel Company, Inc.

m radial flow pattern. Noise reduced by dispersing sound energy. *Allied Witan Co.*

CIRCLE NO. 22, PAGE 13-14

Hydryzing furnaces for hardening high carbon and high speed tool steels. Atmosphere produced by cracking hydrocarbon constituents of gas over a heated catalyst. *Lindberg Engineering Co.*

CIRCLE NO. 23, PAGE 13-14

Turbo blowers ranging from 250 cfm at eight oz to 2650 cfm at 24 oz. Said to be ideal for 24 hr operation over extended period. Recommended for supplying air to gas, oil burners. *Hauck Manufacturing Co.*

CIRCLE NO. 24, PAGE 13-14

Ball bearings developed for belt conveyor rollers. Both inboard and outboard mountings in variety of seals. *Marlin Rockwell Corp.*

CIRCLE NO. 25, PAGE 13-14

L. P. gas now available as original equipment on all models of Coles mobile cranes. Said to give lower fuel costs and overall maintenance. *Coles Cranes Inc.*

CIRCLE NO. 26, PAGE 13-14

Packless solenoid valve, type A. Valve normally closed, opens when hermetically sealed solenoid is energized. When open valve not affected by flow or back pressure, when closed, line pressure is on top of disc. *Magnatrol Valve Corp.*

CIRCLE NO. 27, PAGE 13-14

Ear Plugs, noise-repelling plastic, one type for low frequency, other for low and middle range. Known as "Saf-Ears", claims attenuations up to 45 d.b. in noisy factories. *Hartford Ear & Acoustic Laboratories.*

CIRCLE NO. 28, PAGE 13-14

Cleaner, degreaser in 16-oz aerosol container. After application deposits rinsed with water. Designed for inaccessible areas. *Krylon, Inc.*

CIRCLE NO. 29, PAGE 13-14

Wet cutting abrasive blade, CW-3140 for use on fire clay refractories. Also used on natural stone and many building materials. *Clipper Manufacturing Company.*

CIRCLE NO. 30, PAGE 13-14

Proportioning system, fully automatic, electronically controlled. Records formulas and weighings on summary punch card. Select O Weigh has re-

CIRCLE NO. 128, PAGE 13-14

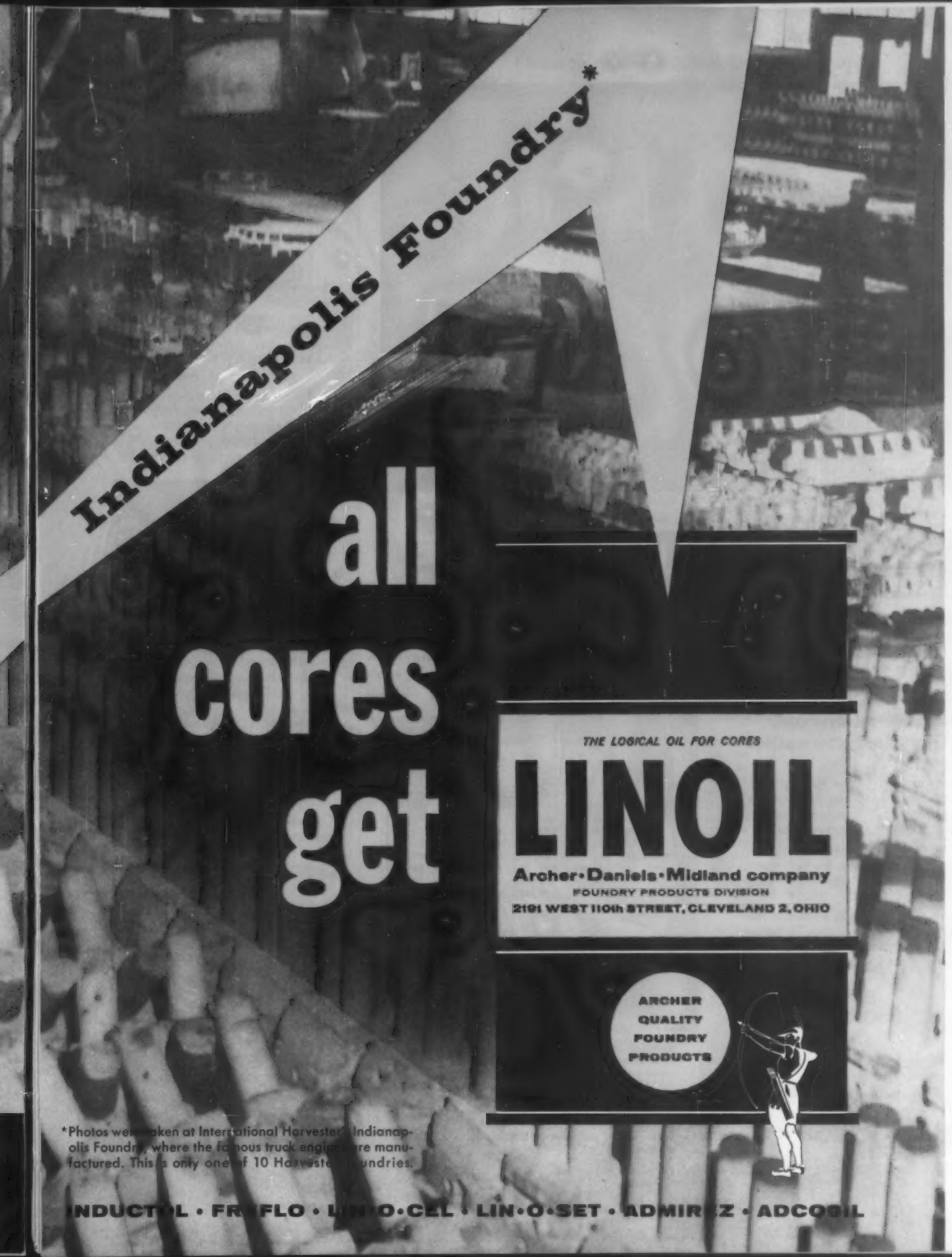
HAND CRAFTED CORES

ROTO-BLOWN CORES

SAND SLINGER CORES

at International Harvester

ADM also makes


Indianapolis Foundry*
all cores get
THE LOGICAL OIL FOR CORES
LINOIL
Archer-Daniels-Midland company
FOUNDRY PRODUCTS DIVISION
2191 WEST 110th STREET, CLEVELAND 2, OHIO
ARCHER QUALITY FOUNDRY PRODUCTS
*Photos were taken at International Harvester's Indianapolis Foundry, where the famous truck engines are manufactured. This is only one of 10 Harvester foundries.
INDUCTOL • FREFLO • LIN-O-CEL • LIN-O-SET • ADMIREZ • ADCOSIL

cording device interlocked with panel action. *Richardson Scale Co.*

CIRCLE NO. 31, PAGE 13-14

Hydraulic fluid with fire-resistant qualities prevents burning on contact with flames. Irus Fluid 902 is noncorrosive on ferrous and most nonferrous materials, compatible with normal system components. *Shell Oil Co.*

CIRCLE NO. 32, PAGE 13-14

Anodizing rack, is claimed to have six times normal capacity with faster deracking, greater flexibility and more uniformity of anodized parts. *Service Products Co.*

CIRCLE NO. 33, PAGE 13-14

Flooring compound, quick setting "Stonhard", allows concrete floor repairing in 30 min. No primer needed, blends in with surrounding area. *Stonhard Company.*

CIRCLE NO. 34, PAGE 13-14

Fork lift truck, can work in six-foot aisles. Battery powered, has side loading. Type TE-4 has 4000-lb capacity. Standup rider type. *Baker-Rauland Co.*

CIRCLE NO. 35, PAGE 13-14

Corrugated boxes and linings now being used for crucible shipments. Advantages claimed; less weight, cleaner and uniform shape. *Electro Refractories & Abrasives Corp.*

CIRCLE NO. 36, PAGE 13-14

Portable storage rack, all-steel for stacking packaged goods three or four high. No bolts used, crossbars & uprights are slip fit. *Paltier Corporation.*

CIRCLE NO. 37, PAGE 13-14

Weight slide rule has calculations for most materials and can give figures for almost any shape. Anodized aluminum face with black graduations. *American Pattern.*

CIRCLE NO. 38, PAGE 13-14

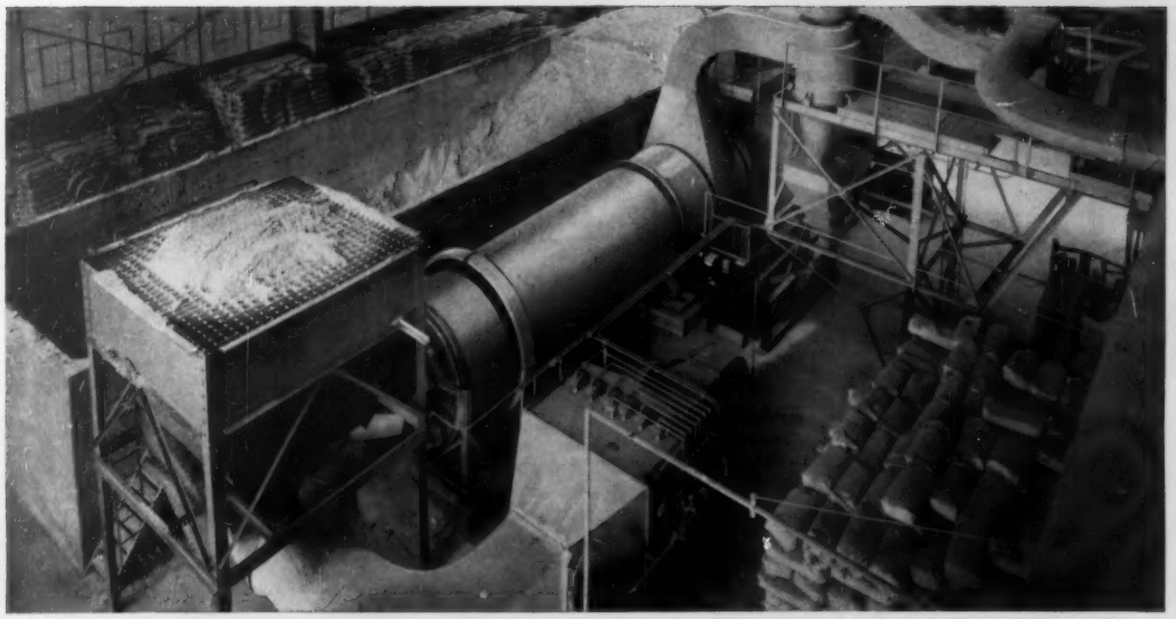
Sight glasses for furnaces with direct seal. Windows when tested on helium leak detector show no leaks at maximum sensitivity. *Corning Glass Works.*

CIRCLE NO. 39, PAGE 13-14

Portable lift, cap. to 2,000 lb, 2-position forks, built-in charger, remote control with retractable cord. Utilizes 12V power system. Heavy duty rollers, heat treated alloy steel link chain. *Oster Manufacturing Co.*

CIRCLE NO. 40, PAGE 13-14

CIRCLE NO. 128, PAGE 13-14



Link-Belt Roto-Louvre dryer above handles 15 tph of sand at large midwest foundry. Sand is delivered from dump hopper to dryer by 16-in. screw feeder. Heated input air is supplied by gas-fired furnace in foreground.

DRY MORE SAND IN LESS SPACE

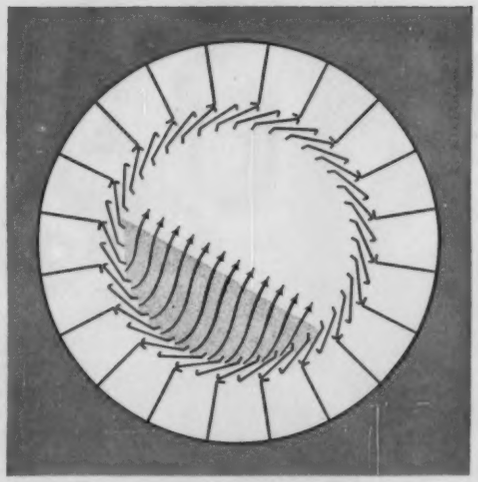
LINK-BELT Roto-Louvre Dryers deliver cool, uniformly dried sand that gives you better castings

YOU can't produce top quality castings unless you use sufficiently cooled, dry sand. And many foundries have discovered the low-cost answer to needed capacity in the Link-Belt Roto-Louvre Dryer utilizing *controlled* high temperatures.

Roto-Louvre's efficiency develops from an exclusive design by which dry air introduced through the louvres contacts every particle. You get maximum capacity in half the space generally demanded by other equipment.

What's more, dependable heat control avoids problems encountered with other dryers using high temperatures. Ordinary types often produce sand too hot to handle readily—that won't mix properly with core oil. Alternative: an extra cooler, needless expense.

Get complete information from a foundry specialist through your nearest Link-Belt office. Or write direct for Book 2511.



Gradual heat transfer from gentle rolling action over slowly revolving louvres eliminates spotty over- or under-drying. Sand is discharged at 120 to 135° F, containing a maximum of 0.5% of moisture. In installations where temperatures to as low as 100° F are required, a combination dryer-cooler can be furnished. Link-Belt builds eight sizes of Roto-Louvre Dryers—in capacities from 1 to 60 tph.

LINK-BELT

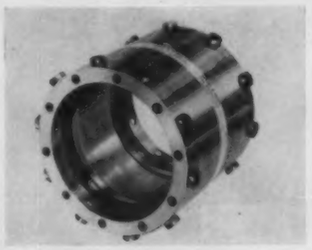
13,750

HANDLING and SAND PREPARATION MACHINERY

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville, N.S.W.; South Africa, Springs. Representatives Throughout the World.

CIRCLE NO. 129, PAGE 13-14

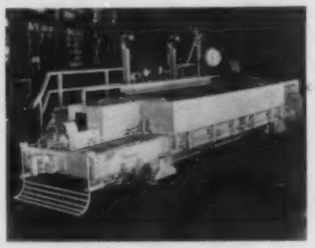
Packing ring, asbestos-mica, with high temperature resistance, molded into coupling at factory. "Weld-Ends"



have withstood 1500 psi at 1000 F, come in any style of packing two to 36 in. *Pipe Line Development Co.*

CIRCLE NO. 41, PAGE 13-14

Blast furnace scale car, has two bins, 160 cu ft each, air-operated. Self-propelled, speed up to 500 fpm when fully loaded. Weighing by au-



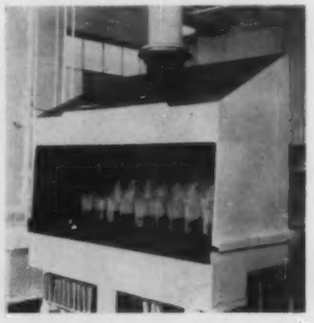
tomatic recording scale. *Pennsylvania Engineering Corporation.*

CIRCLE NO. 42, PAGE 13-14

Tractor-shovel, pneumatic tired, four-wheel drive, front end loading, winner of Industrial Design Institute Award. *The Frank G. Hough Co.*

CIRCLE NO. 43, PAGE 13-14

Laboratory fume hood and exhaust system made of corrosion resistant



plastic. Said to have resistance to wide variety of corrosive agents. *Haveg Industries, Inc.*

CIRCLE NO. 44, PAGE 13-14

End-shield bearing synchronous motor. Split bearing-supporting end

shields, collector assembly located within frame. Winding given ASA dielectric test. *Allis Chalmers Manufacturing Co.*

CIRCLE NO. 45, PAGE 13-14

Akaline burnishing compound for zinc die castings, FM 186. A liquid usable for self-tumbling, shot or synthetic media. Also for steel and copper alloys. *Oakite Products, Inc.*

CIRCLE NO. 46, PAGE 13-14

Lever hoist, 3/4 ton cap. uses only 1/3 arc movement for operation. Designed for angular, horizontal or vertical lifting. Guaranteed rustproof. *Thern Machine Co.*

CIRCLE NO. 47, PAGE 13-14

Refractory motor, a sillimanite base for use where high slagging and other severe conditions require a high fusion, air and gas tight slag-resistant joint material. *J. H. France Refractories Co.*

CIRCLE NO. 48, PAGE 13-14

Cutting Oil aerator with "Thru-hole" construction claims bubble action eliminates splashing. Pipe size 3/8 to 1 in. *American Aerator Co.*

CIRCLE NO. 49, PAGE 13-14

Diaphragm type solenoid valve, K-181, for "off-shelf" multi-purpose use. Handles large capacities with minimum pressure drop. Pressures up to 250 psi. Standard and hot water models. *General Controls Co.*

CIRCLE NO. 50, PAGE 13-14

Automatic scale, H-39 comes in 200 lb & 500 lb models. Hourly capacities of 20, 40 tons. Also has auxiliary equipment. *Richardson Scale Company.*

CIRCLE NO. 51, PAGE 13-14

Bureau Acquires New Site

Positive action has been taken for relocating the Washington laboratories of the National Bureau of Standards to a 550 acre site near Gaithersburg, Md. Transfer of operations is expected to be completed in about five years.

The Bureau has been at its present location since 1903 and facilities have been inadequate for many years. Renovation and modernization of present facilities would cost more than half of the estimated expense for new facilities which will allow a broader range of activities without urban interference.

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AFS Group Approves Air Pollution Manual

Practical suggestions and solutions to air pollution problems as well as their cause, results and effects on the foundry and its neighborhood are contained in the foundry air pollution control manual expected to be published this month by AFS. A condensation of this information forms the bonus section of September's MODERN CASTINGS. Approval of the manual was given by the Air Pollution Control Committee of the American Foundrymen's Society at its July 17 meeting in Detroit.

The manual will contain nine sections: introduction; statement of the problem; legal aspects of air pollution; air pollution and community relations; metallurgy and topography; atmospheric sampling and analysis; control equipment; maintenance and operating procedures and bibliography.

Committee members are F. A. Patty, chairman, J. A. Radcliffe, vice chairman, E. A. Adams, Lester V. Cralley, Richard B. Engdahl, David E. Gilchrist, John M. Kane, J. P. Moehling, Jr., R. H. Mooney, Garnet P. Phillips, Richard Pring, R. J. Ruff and Kenneth M. Smith. Herbert J. Weber, AFS director of safety, hygiene and air pollution control is an ex-officio member.

Foundry Accidents Increase

During 1955 the frequency of accidents in the foundry industry increased seven per cent over 1954 figures while the severity rate declined six per cent. This is the reverse of the trend of 40 basic industries reporting to the National Safety Council.

Average accident frequency rates in all industries, based on the number of disabling injuries per million man-hours, was 6.96. The foundry industry's rate was 9.45. The average accident severity rate for all industries, based on the number of days lost per million man hours, was 815. The foundry industry showed 814.

A disabling injury is one which results in the complete inability of a person to perform his usual activities for at least 24 hours or results in a permanent impairment.

let's get personal

Carl E. Allen . . president of Campbell, Wyant and Cannon Foundry

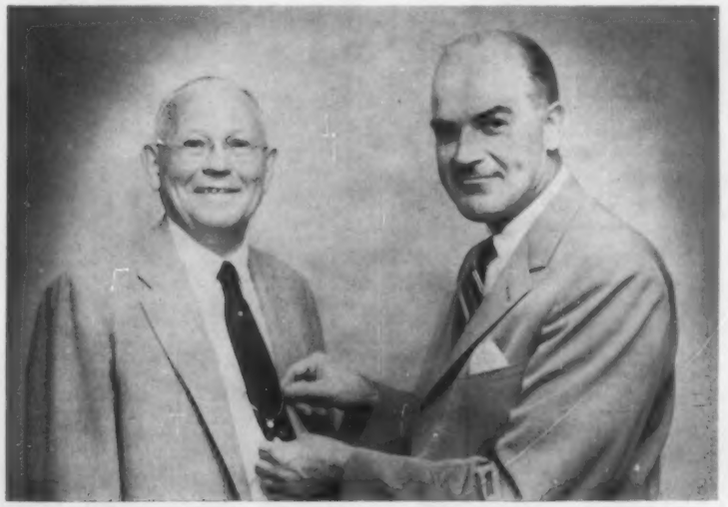
C. E. Allen

Div., Textron, Inc., Muskegon, Mich., has been elected president of the Federal Reserve Bank of Chicago. The post covers the largest banking district in the nation. **Richard L. Lindland,** vice-president and secretary of CWC, will assume the post held by Allen since moving to Muskegon in 1950 from the National City Bank of New York. Before Textron, Inc.'s, recent purchase, CWC was the world's largest independent gray iron foundry.

A. K. Kiesler . . research associate for General Electric Co., Schenectady, has been elected to succeed **James H. Lowe** as chairman of the American Foundrymen's Society Steel Division Program and Papers Committee.

Jack J. Begley . . has been named vice-president in charge of manufacturing for Colson Corp., Elyria, Ohio, manufacturers of casters and wheel products.

Harry W. Dietert, vice president of the American Foundrymen's Society and chairman of the board of Harry W. Dietert Company, will



Fifty years with Link-Belt. N. Stanley Snyder, district manager of Link-Belt's Buffalo office receives his service pin from D. E. Davidson, sales v-p. Snyder began his career with the company at 13 as a file clerk and then studied engineering at night, beginning his career in 1906.

There's a
TENNESSEE
FERRO ALLOY
to suit your needs to a

• Weighing is not necessary with TENNESSEE ferro alloy briquettes. They contain exact quantities of alloy, making it easy to control cupola charges. Just count 'em and toss 'em in. TENNESSEE briquettes are available in ferrosilicon, ferromanganese, ferrochrome and silico-manganese. Also available in lump and crushed forms. Warehouses at Pittsburgh, Chicago, Chattanooga and Houston. Other TENNESSEE metallurgical products: Pig iron and foundry coke.

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CHEMICAL, PAINT AND METALLURGICAL DEPARTMENT OF MERRITT-CHAPMAN & SCOTT CORPORATION
CIRCLE NO. 130, PAGE 13-14

We've doubled our capacity for SILICO-MANGANESE

One of the new silicomanganese furnaces at our Philo, Ohio plant.

Ohio Ferro-Alloys has been a continuous producer of silicomanganese since 1952. To assure an ample supply for the future needs of the iron and steel industry, new facilities which double previous capacity are now in operation at our Philo, Ohio plant.

Recommended as an effective and economical deoxidizer, silicomanganese will save you furnace time and produce cleaner steel. Ohio Ferro-Alloys' silicomanganese is available in three carbon grades. Each is properly sized for either furnace or ladle additions to meet your requirements.

Ohio Ferro Products

- FERRO - SILICON 25 - 50 - 65 - 75 - 85 - 90%
- SPECIAL BLOCKING 50% FERRO - SILICON
- SILICON METAL
- HIGH CARBON FERRO-CHROME
- LOW CARBON FERROCHROME
- LOW CARBON FERRO-CHROME SILICON
- FERRO - MANGANESE
- SILICO-MANGANESE
- MED. CARBON FERRO-MANGANESE
- BOROSIL
- SIMANAL
- RARE EARTH ALLOYS

Briquets

- SILICON
- MANGANESE
- CHROME
- SILICO-MANGANESE

PHILO · TACOMA · BRILLIANT

Ohio Ferro-Alloys Corporation
Canton, Ohio

Chicago Detroit Pittsburgh Tacoma Seattle Denver
Minneapolis Birmingham San Francisco Los Angeles

CIRCLE NO. 131, PAGE 13-14

present the AFS official exchange paper at the 23rd International Foundry Congress in Dusseldorf, Germany in September. The title of his paper is "Elevated Temperature Testing and Its Correlation with Casting Defects."

H. W. Dietert

The National Castings Council has announced that the following have been elected to office for the 1956-57 year, president: **Paul L. Arnold,** U. S. Pipe & Foundry Co., Chattanooga, Tenn., and president of the National Foundry Association; vice-president: **Thomas Rutherford,** Midvale Co., Philadelphia, and president of the Alloy Castings Institute; treasurer: **F. Ray Fleig,** Smith Facing & Supply Co., Cleveland, representing the Foundry Facing Manufacturer's Association; secretary: **F. G. Steinebach,** Penton Publishing Co., Cleveland.

Charles W. Briggs, technical & research director of the Steel Found-

C. W. Briggs

ers' Society of America, will also address the International Foundry Congress. His paper is "Green Sand Molding of Large Steel Castings."

Texas Foundries, Lufkin, Tex., has increased its staff with the follow-

ing new staffers: **Ted Cramer** has moved from National Engineering Co. to join Texas Foundries as assistant to the plant engineer; **Cary Eman** has been assigned to the work simplification of industrial engineering department.

P. R. Rentschler

Peter Robert Rentschler . . has been elected secretary and director of the Hamilton Foundry and Machine Co., Hamilton, Ohio. He also has been elected secretary and director of the Decatur Casting Co., Decatur, Ind. Rentschler is the fourth generation of his family to be active in the management of the company.

Dr. Paul V. Faragher . . authority on the establishment of standards for light metals has retired after 37 years with Aluminum Co. of America.

R. A. Aeberly . . has been appointed Los Angeles district manager for Electro Metallurgical Co. He

R. A. Aeberly

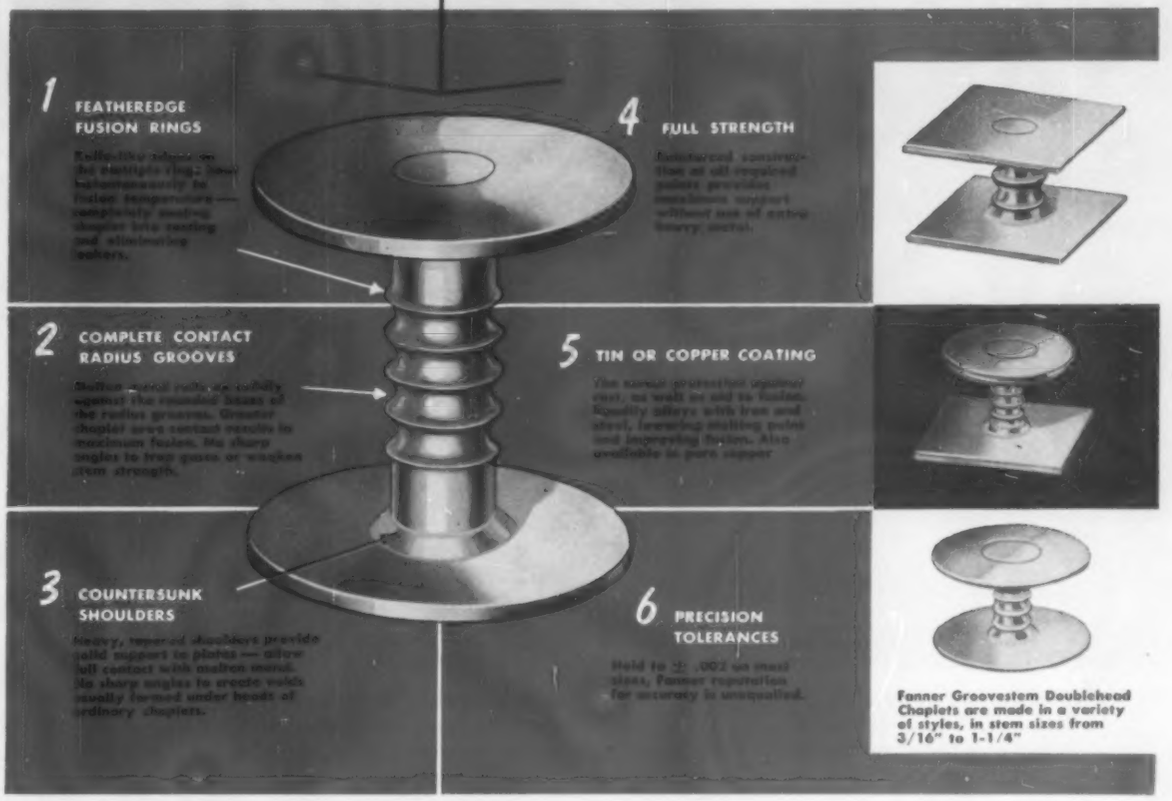
has been a sales and service engineer for the company in the Chicago area.

Bernhard W. Weber . . has been named to head manufacturing operations of Metal & Thermit Corp.

get maximum fusion and solid core support

with fine FANNER

DOUBLE HEAD GROOVESTEM CHAPLETS



Fanner Groovestem Doublehead Chaplets are made in a variety of styles, in stem sizes from 3/16" to 1-1/4"

■ Have you checked into the exclusive features of fine Fanner Double Head Groovestem Chaplets? Foundries everywhere have found that this design makes a tremendous improvement in the production of higher quality castings through solid core support . . . complete fusion . . . freedom from leakers and accurate wall thicknesses! Firms doing critical casting work standardize on Fanner Groovestem Chaplets because of the superiority proven in their own production. Get complete information by writing for samples and prices now!

Engineering Service

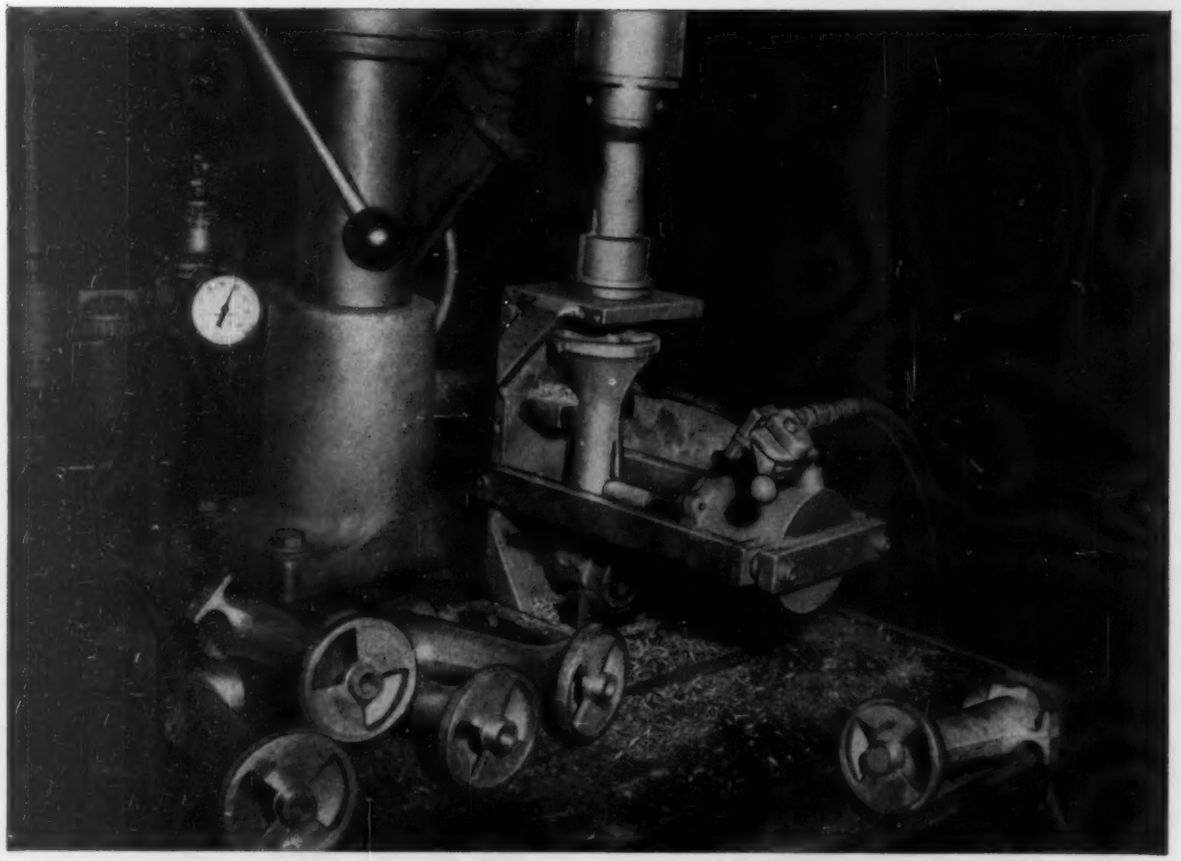
Qualified and specialized engineers in FANNER's Technical Service Division are available for consultation, without obligation, on problems of producing more intricate castings; developing increased strength, closer tolerances, and better quality; reducing machining and improving finish — both in ferrous and non-ferrous castings. Take advantage of the research and development work that FANNER has invested in this field to improve your profit picture. Simply direct your request to the address shown below.

THE FANNER MANUFACTURING CO.

BROOKSIDE PARK CLEVELAND 9, OHIO

Designers and Manufacturers of Fine Fanner Chaplets and Chills

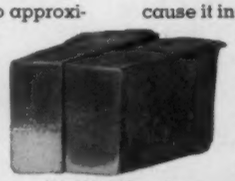
CIRCLE NO. 132, PAGE 13-14



Machining Rate Increased 25% by Adding "SMZ" Alloy

Machining the gas burner castings above was often very difficult due to chilled corners and edges. These chilled spots caused excessive tool wear and breakage, interrupting production in the machine shop. When the foundry received complaints about the poor machinability of these castings, they added 3 pounds of "SMZ" alloy per ton to the molten iron in the ladle. The "SMZ" alloy cut chill depth from an average of ½ in. to approximately ⅛ in., as shown in the chill specimens below. The effect of this treatment was noticed immediately in the machine shop: the machining rate was increased by 25 per cent and tool breakage was eliminated.

This is one of many examples where a small addition of "SMZ" alloy markedly reduced the chilling properties of cast iron without sacrificing the mechanical properties of heavier sections. "SMZ" alloy is a strong, carefully balanced inoculant containing 60 to 65 per cent silicon, 5 to 7 per cent manganese, and 5 to 7 per cent zirconium. Besides reducing the chill in cast iron, "SMZ" alloy is used in the production of high-strength iron because it increases tensile and transverse properties.



Chill Blocks

Your nearest ELECTROMET office will be glad to give you additional information about the advantages of using "SMZ" alloy. Ask for the booklet, "SMZ Alloy—An Inoculant for Cast Iron," which gives actual examples of the use of this important ladle addition alloy.

ELECTRO METALLURGICAL COMPANY

A Division of Union Carbide and Carbon Corporation

30 East 42nd Street UCC New York 17, N. Y.

OFFICES: Birmingham · Chicago · Cleveland · Detroit
Houston · Los Angeles · New York · Pittsburgh · San Francisco

In Canada: Electro Metallurgical Company, Division of Union Carbide Canada Limited, Welland, Ontario

The terms "Electromet" and "SMZ" are registered trade-marks of Union Carbide and Carbon Corporation

CIRCLE NO. 133, PAGE 13-14

H. A. Rack succeeds Weber as production manager. **D. W. Oakley** has been transferred to new post as technical advisor to the president of the firm.

Alloy Casters: Bradley B. Evans and F. M. Fahrenwald.

Newly elected officers of the Alloy Casting Institute are: **Bradley B. Evans,** Empire Steel Castings, Inc., Reading, Pa., president; and **F. M. Fahrenwald,** Fahralloy Co., Harvey, Ill., vice-president.

American Society for Testing Materials has cited for outstanding service technical leaders in the field of engineering materials, including the following: **Harry A. Bright,** chief, analytical chemistry section, division of chemistry, National Bureau of Standards; **William L. Fink,** chief, physical metallurgy division, Aluminum Co. of America; **Bruce W. Gonser,** assistant director, Battelle Memorial Institute; **Vincent T. Malcolm,** consultant and advisory engineer, Chapman Valve Mfg. Co.

Frank De Matteo . . has been named controller and chief accountant of the Shallway Corp.

Frank De Matteo

Herbert Geittman, Jr. . . is now in charge of Climax Molybdenum Co.'s program of developing castings for the machine tool industry.

He was formerly foundry manager of Richmond Foundry and Mfg. Co.

Robert G. Hess . . has been elected executive vice-president of the Walworth Co.

C. R. Tighe

Charles R. Tighe . . has been named industrial advertising manager of the Joseph Kixon Crucible Co., Jersey City, N. J.

Hooker Electrochemical Co. has named **L. J. Pentland, E. E. Graham,** and **H. B. Puff** has been promoted to district sales manager for New York, California, and Chicago respectively.

Weldon D. Willes . . has been named assistant to the president of the Locomotive Finished Material Div., Rockwell Mfg. Co.

John B. Seastone . . has been appointed director of the technical division of Olin Mathieson Chemical Corp.

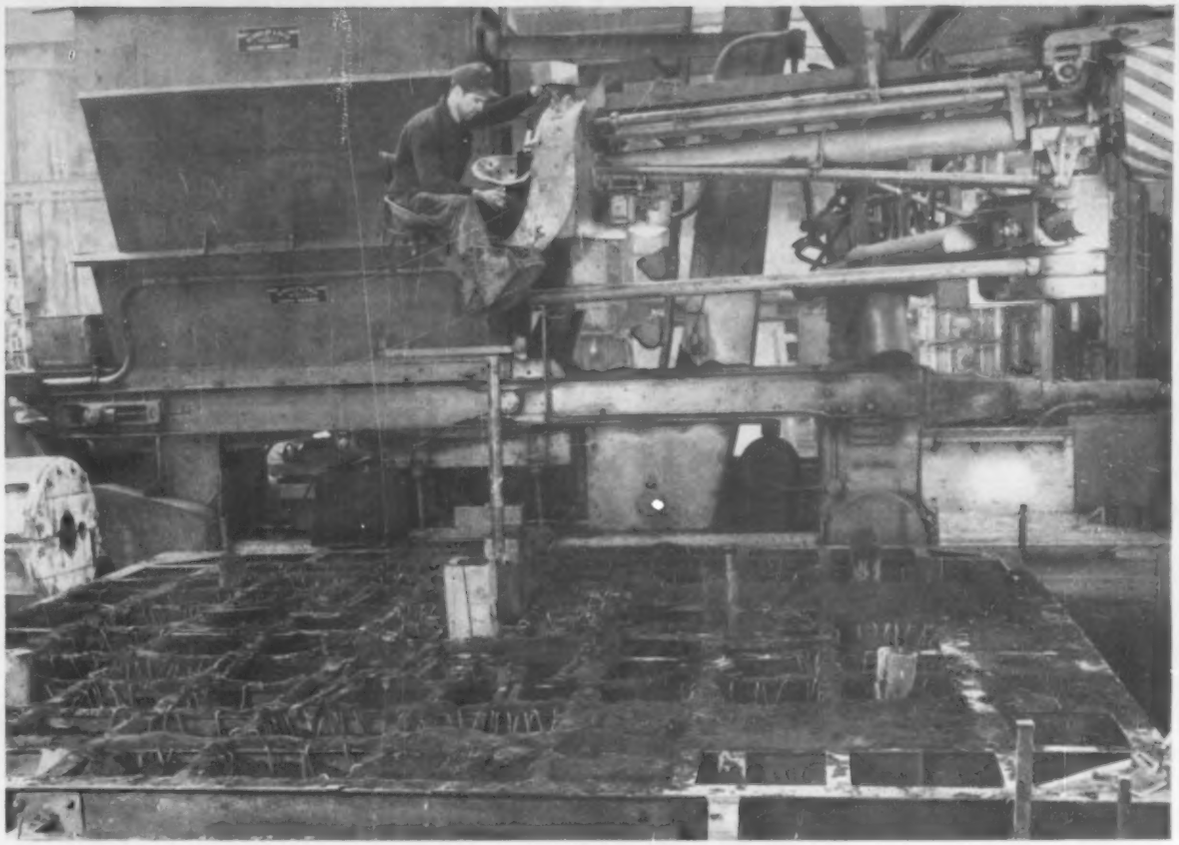
Russell S. Whitehead . . has been promoted to Southeast district sales manager of Electro Refractories & Abrasives Corp.

Les Haisen . . is now manager of a new West Michigan branch sales office for Vickers, Inc.

Raymond W. Cummings . . has joined Crouse-Hinds Co. as controller.

Answer questions by sending for data describing the newest products and processes. Order now by using the cards on **page 13-14.**

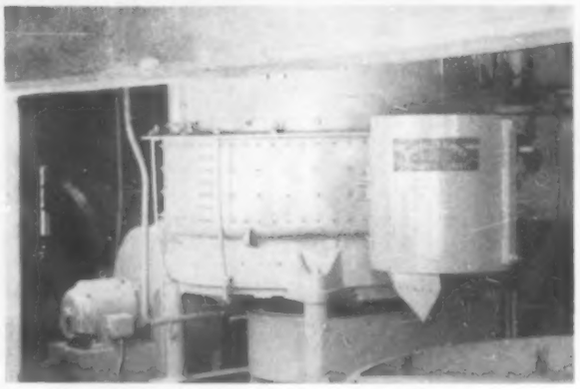
American mechanization in German foundry boosts production from 150 to 700 tons a month



A CASE STUDY at Escher Wyss, Ravensburg, Germany where B & P Speedslinger mechanization has boosted production from 150 to 700 tons a month.

Escher Wyss of Ravensburg, Germany, was called upon to nearly quadruple its monthly output *without materially changing its building.* The installation of a B & P Model '60' Speedmullor and a B & P Motive Speedslinger provided the production needed. Quality has been boosted too. The whole story is told in the September issue of Better Methods magazine published in conjunction with Beardsley & Piper's participation in the International Foundry Trades' Fair at Dusseldorf, Germany.

Send for your copy today and see how this German plant has benefited.



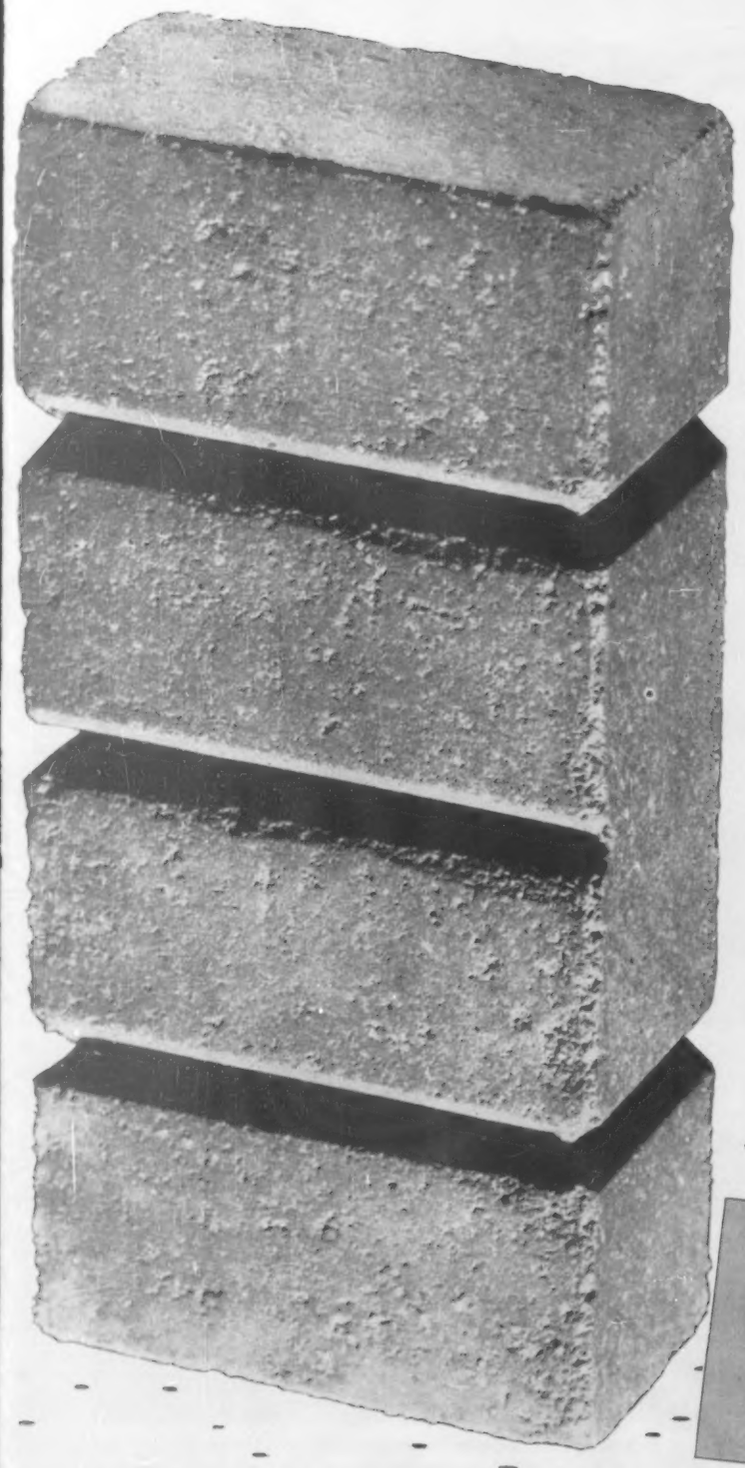
Operated three shifts daily since its 1948 installation, this B & P Model '60' Speedmullor has provided all of the molding and core sand for the foundry.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF FOUNDRY MACHINERY

LOOK TO BEARDSLEY & PIPER FOR BETTER METHODS

EXHIBITING AT THE INTERNATIONAL FOUNDRY TRADES' FAIR AT DUSSELDORF, GERMANY. SEPTEMBER 1-9, 1956

CIRCLE NO. 134, PAGE 13-14



PURIFYING METAL

with Famous

CORNELL CUPOLA FLUX

Famous Cornell Cupola Flux has been purifying metal year-after-year to the great satisfaction of experienced foundrymen. This is the proof you want when you consider the use of a fluidizer. Over the years, as foundry after foundry tried and approved Famous Cornell Cupola Flux, use of this scientifically prepared mixture of high grade fluorspar and other materials increased tremendously!

And no wonder! Famous Cornell Cupola Flux creates a chemical reaction in molten iron. This reaction *purifies* the iron so that all the slag floats off. For use in gray iron and malleable foundries melting in cupolas.

Scored Brick Form

Famous Cornell Cupola Flux is made in easy-to-use scored brick form. With each charge of iron, you toss one brick into the cupola. It costs only a few cents per ton of metal—*only a few cents* to guarantee that the metal you pour—that the castings you get are of superior quality. Insist on Famous Cornell Cupola Flux—*often imitated but never equalled.* To contact a Cornell sales engineer, call or write us today. Ask also for Bulletin 46-B.

OFTEN IMITATED – NEVER EQUALLED!

Be sure to Try
Famous **CORNELL**
Aluminum Flux

Be sure to Try
Famous **CORNELL**
Brass Flux
Send for Free BULLETIN 46-A

The **CLEVELAND FLUX** *Company*
1026-40 MAIN AVENUE, N. W. • CLEVELAND 13, OHIO
Manufacturers of Iron, Semi-Steel, Malleable, Brass, Bronze, Aluminum and Ladle Fluxes—Since 1918

FAMOUS CORNELL FLUXES
Trade Mark Registered

Modern Castings Names J. H. Schaum Editor

Jack H. Schaum, of the experimental foundry department of the National Bureau of Standards, is the new editor of MODERN CASTINGS. He succeeds Herbert F. Scobie, who resigned in June to join the Non-Ferrous Founders' Society.

Schaum is widely known in the castings industry for his original research with both the Bureau of

Jack H. Schaum

Standards and the Naval Research Laboratory. He is also chairman of the Chesapeake Chapter of the American Foundrymen's Society and secretary-treasurer of the Washington Chapter, American Society for Metals.

Schaum is a metallurgical engineer, graduate of Massachusetts Institute of Technology in 1940. There he was editor-in-chief of the monthly undergraduate magazine, Tech Engineering News.

After graduation from MIT, Schaum was employed as a metallurgist at Lewis Foundry & Machine Co., Babcock and Wilcox Co., the Bureau of Mines, Naval Research Laboratory and National Bureau of Standards.

He has spent the past 12 years in the experimental foundry of the latter two establishments. There he has been engaged in castings research involving most of the ferrous and non-ferrous casting alloys and problems associated with green sand molding, shell molding, plaster molding and investment casting. He is the author and co-author of numerous technical papers, including four papers presented to AFS and one presented to Gray Iron Founders' Society.

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pouring off the heat

Best Convention Yet

■ I want to compliment you all in AFS very highly for the fine exhibition you and your organization put on. There seemed to be more dignity shown by the management, those showing exhibits, the individuals attending and the convention as a whole. The old days have surely passed along with the times. This is all very commendable to the industry.

This was the first time that I was in at the opening and stayed until the close and I found it most interesting and educational . . . I don't see how, in these fast advancing times, any foundryman can afford not to spend some time at the AFS convention to keep abreast of the times. It is the one place where it is possible to see the progress of everything in the castings industry.

George W. Cannon
Muskegon, Mich.

Visible Records

■ We are interested in installing a visible-record type of production control system in our job-shop magnesium foundry, and we are looking for more sources for this information.

As of this date we have contacted Remington Rand, International Business Machines, the McBee Company, the Wassell Organization, Inc., and the Acme Visible Records Co., but we feel there are more information sources which we are unaware of.

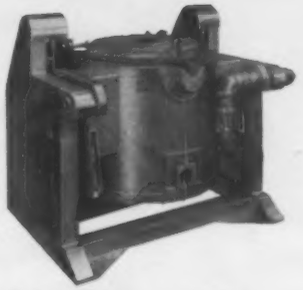
Can you help us by supplying the names of any other firms who may have a *visible* type of producton control system?

Dale A. Johnson
Industrial Engineer
The Wellman Bronze and Aluminum Company
Cleveland, Ohio

Conditions of Sale

■ We have been receiving a number of nice comments on the splendid way in which you illustrated our Industry's "Terms and Conditions of Sale."

You may be interested to know that since your July issue appeared, we have received inquiries about this form from some of our own member companies despite the fact that they



Lindberg-Fisher type MNP nose-pour tilting crucible furnace. Pouring lip is located in the axis of tilting providing a constant pouring arc regardless of degree of furnace tilt. Capacities up to #800 crucible with brass, up to #1000 crucible with aluminum. Oil or gas fired. Described in Bulletin 57-A.

Lindberg-Fisher Electric Resistance Melting and Holding Furnace equipped with heavy duty resistance elements which give uniform distribution of heat, insuring long element and pot life. Capacities 250 to #1000 crucible.

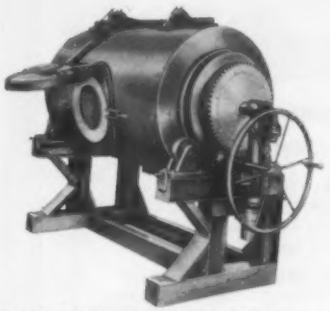
For Non-Ferrous Metals
A complete line of

LINDBERG FISHER

MELTING AND HOLDING FURNACES

For Melting Aluminum • brass • yellow brass bronze • copper • copper nickel alloys • lead magnesium • nickel • tin • zinc.

Because Lindberg-Fisher builds *all* kinds of melting equipment . . . gas . . . oil . . . electric . . . induction, and Carbon arc . . . L-F engineers are able to recommend, without prejudice, the proper type of furnace for *your* particular melting requirements.



Lindberg-Fisher Simplex Rotary Open-Flame Furnace. Capacities to 2400 lbs. aluminum. 6000 lbs. brass. Oil or gas fired. Described in Bulletin 29-A.

Lindberg-Fisher type BB1 Hand-Tilt Crucible Furnace. Tilting mechanism consists of a hand wheel, driven through machined worm gear and pinion reducing gears. Capacities 50 to #400 crucible. Oil or gas fired. Described in Bulletin 400.

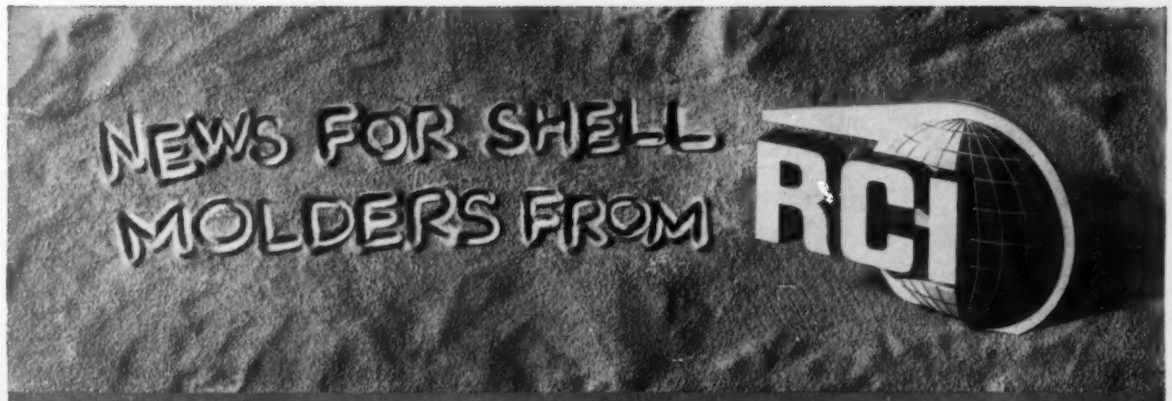
Lindberg-Fisher type SF stationary crucible furnace features rapid melting and is recommended for general foundry casting work. Capacities 30 to #400 crucible. Oil or gas fired. Described in Bulletin 301.

Melting specialists for 25 years
Sales and service offices in principal cities

LINDBERG FISHER MELTING FURNACES

A Division of Lindberg Engineering Company, 2440 West Hubbard Street • Chicago 12 • Illinois

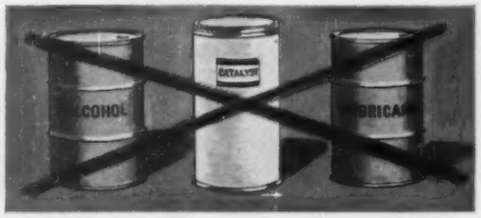
CIRCLE NO. 136, PAGE 13-14



New RCI system simplifies cold coating of sand

May be used for producing shell molds or shell cores by dump box or blowing methods

Now, with the new RCI system, *all you need is two materials* for cold coating sand (besides the sand). One is a powdered phenolic resin, RCI FOUNDREZ 7555. The other is an alcohol solution of a phenolic resin, RCI FOUNDREZ 7150.



No longer do you need to purchase and handle alcohol, catalysts, lubricants and so forth.

Amount of resin needed: The amount of resin required for a given mix will, of course, depend on whether you are coating sand for dump-box operation or for blowing shells and cores (and will vary considerably with the type of sand used). But the experience of RCI Technical Service men in the field indicates that for shell cores about 2-4% resin will be satisfactory. For dump-box operations or blown shells a range of 3-5% will generally be enough.

Other Advantages of RCI coating system

1. **Speed of coating**—release of alcohol from the resin itself accelerates actual coating of the sand. You cut mulling time about 35 to 45% . . . **reduce resin dust, too.**
2. **Strength of bond**—because the RCI system coats more efficiently than the powder and alcohol method, you get greater dry tensile strength (on an equal solids basis). You also get better economy and reduced gas content.
3. **Rate of production**—lowered investment time as well as cure time with this system gives you a higher rate of production for both cores and molds.
4. **Release characteristics**—you will find a marked improvement in the ease with which cores and molds are released from the boxes and patterns.
5. **Resin stability**—both the powdered resin, FOUNDREZ 7555, and the liquid resin, FOUNDREZ 7150 are very stable. You can store them for long periods of time (the powdered resin kept cool and dry to prevent lumping).

Write for full information. If you would like to know the procedure and typical formulations for simplified cold coating with the new RCI system, write today for *Technical Bulletin F-10.*

Creative Chemistry . . . RCI
Your Partner in Progress

REICHHOLD

Synthetic Resins • Chemical Colors • Industrial Adhesives • Plasticizers
Phenol • Formaldehyde • Glycerine • Phthalic Anhydride • Maleic Anhydride
Sodium Sulfite • Pentaerythritol • Pentachlorophenol • Sulfuric Acid

REICHHOLD CHEMICALS, INC., RCI BUILDING, WHITE PLAINS, N. Y.
CIRCLE NO. 137, PAGE 13-14

have been exposed to it scores of times since its inauguration in 1931!

Donald H. Workman
Executive Vice President
Gray Iron Founders' Society
Cleveland, Ohio

■ The "Foundry Facts—Trade Practices/Gray Iron" as the insert in the July, 1956, issue of MODERN CASTINGS, is a real service to the industry.

The Hamilton Foundry &
Peter E. Rentschler, *President*
The Hamilton Foundry & Machine Co.
Hamilton, Ohio

Missed balancing act

■ Looking through the June issue of MODERN CASTINGS at the convention pictures I see you did not get all of your names right. The lady balancing the cup and saucer in the picture on page 12 is very definitely me—Mrs. W. L. Chatfield.

Sincerely,
Mrs. W. L. Chatfield

MODERN CASTINGS *is very definitely sorry that it missed Mrs. Chatfield who attended the Castings Congress with her husband, foundry manager of the Fate-Root-Heath Co., Plymouth, Ohio.*

Defect in die cast article

■ In the July, 1956 MODERN CASTINGS article "Once There Was a Hard Spot in an Aluminum Die Casting" there is an error in table three, page 30. The table is incorrectly headed "Segregation at adequate temperature with adequate mixing." It should read "segregation at adequate temperature with *inadequate* mixing."

Donald L. Colwell
Director of Laboratories
Apex Smelting Co.

Researchers Bomb Metals

Basic information concerning the relationship between crystalline structure and the physical structure of metals is anticipated through experiments of radiation damage to metals. These investigations are being launched at Northwestern Technological Institute in a project supported by the Atomic Energy Commission.

Changes in crystalline structures will be produced by using high energy electrons to displace atoms from their normal positions in the structure.

S. C. Massari Returns as AFS Technical Director

S.C. Massari has succeeded H.J. Heine as technical director of the American Foundrymen's Society. Massari left his post as director of research for National Engineering Co., Chicago, to assume the new position.

Massari has had a distinguished career in the castings industry since

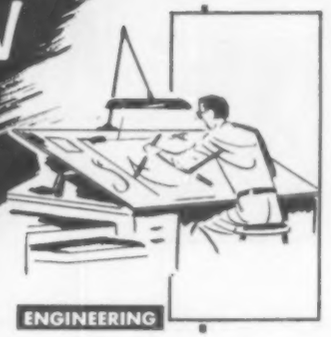
S. C. Massari

his graduation from Massachusetts Institute of Technology in 1924. He served 17 years as chief metallurgist in charge of research for the Association of Manufacturers of Chilled Car Wheels, Chicago. In 1942 he entered the armed services and, as a member of the Army Ordnance Corps, supervised engineering and production of tanks and military vehicles in the Chicago Ordnance District.

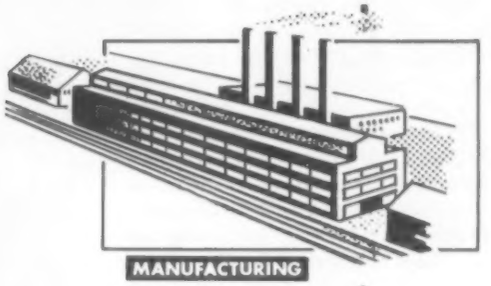
In becoming technical director of the Society, Massari returns to a post he formerly held for 7½ years. At the end of the war he joined AFS as technical director and served in that capacity until 1953. He left AFS to become manager, foundry division, of Hansell-Elcock Co., Chicago, a producer of gray iron castings for the machine tool industry. He later joined National Engineering Company, Chicago, as director of research, the position which he resigned to return to AFS.

Mr. Massari was awarded the John H. Whiting Gold Medal of the American Foundrymen's Society in 1949 and was the Edgar J. Hoyt Memorial Lecturer in 1956, presenting a discussion on "Marketing Your Product." He is a resident and trustee of the Village of River Forest, Chicago suburb.

QUALITY LOW COST NONFERROUS CASTINGS FROM WELL ENGINEERED PRODUCTION PATTERN EQUIPMENT



ENGINEERING



MANUFACTURING

FINISHED PRODUCT

Let Lavin Engineering help to produce quality low cost BRASS CASTINGS.

Costly rejects and low production can be avoided by careful planning of match plate and core box equipment. Spacing of patterns, gating and risering for fluid flow, and engineering core box equipment to produce maximum number of cores per blow are some of the most important factors which contribute to the production of quality low cost castings.

Lavin's metallurgical staff is always ready to assist the foundryman in finding the solution of any routine or special casting problem. Our chemical and research laboratories are available to you at no cost or obligation.

Next time call upon LAVIN'S engineering service

"The Foundryman's Problems Are Our Problems"

R. LAVIN & SONS, inc.

• Refiners of Brass, Bronze and Aluminum
• Producers of Zinc Base Die Casting Alloys

3426 S. KEDZIE AVENUE • CHICAGO 23, ILLINOIS
REPRESENTATIVES IN PRINCIPAL CITIES

56 Years

CIRCLE NO. 140, PAGE 13-14

CHALK TALK on DIAPHRAGM MOLDING

T. E. Barlow / *Sales Manager*
Eastern Clay Products Division
International Minerals & Chemical Corporation

Extremely high squeeze pressures, evenly applied, make process different

The principal difference between high pressure molding and older squeeze techniques is that the diaphragm method depends entirely on squeeze and does not incorporate any secondary method of molding. It achieves this higher pressure with no increase in air line pressure.

The jolt squeeze machine has a fixed piston diameter, which at a given line pressure can transmit only a given force. This force is in turn spread out over a certain flask area; as the flask changes in area, the pressure on the sand also changes—inversely. At 80 pounds pressure, a jolt squeeze machine with a 13-inch piston can apply only 40 psi to a 16-inch square flask. And on a 24-inch square flask the pressure applied falls to just 18 psi!

But on a high-pressure molding machine, the flexible diaphragm takes pressure directly from the air line; line pressure is not turned to a top-limited force and then asked to spread itself thin over a relatively large area. With a diaphragm machine, pressure comes straight through as pressure; 80 psi in the line means 80 psi at all points on the diaphram, and a consequent 80 psi on the sand.

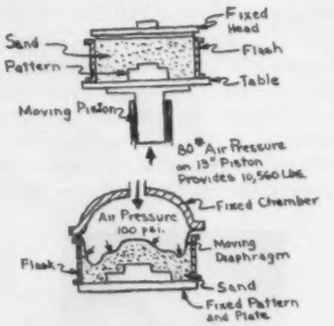


Fig 1 shows how jolt-squeeze machine differs from method of diaphragm molding described.

Is special sand required with the diaphragm principal?

Part of the high pressure picture is the modification of sand practice to develop maximum flowability and low moisture in the fine sands. However, from the standpoint of the diaphragm molding alone, the answer is definitely "no".

About the only requirement to get the full benefit of the diaphragm principal is that the sand be compressible. Most sands do include this property. The only exceptions are the relatively weak molding sands used in some practices. For example, it has been necessary on frequent occasions to increase the clay content of a few naturally-bonded sands to bring their strengths up to 10 or 12 pounds to get sufficient compressibility to give the desired mold hardness. An extremely flowable sand such as a oil or resin core sand built for high speed blowing operations is relatively non-compressible and does not give mold hardness under diaphragm molding. Rather tough, workable sands with green strengths in excess of 12 pounds are generally best. High pressure sand additives provide additional mold density when desired.

What keeps the diaphragm from stretching or bursting?

One patented feature of the technique is the principal of the slack diaphragm. It is this feature that makes the diaphragm process practical. In the top part of Fig 2, you are looking up at the bottom side of the diaphragm in its slack position. The diaphragm is built so as to form a large bag when at rest. The amount of sag can be varied to suit the conditions of the operation.

In actual practice you never see the sag in the diaphragm since it is always sucked up into the head with a suction fan. This is to get it out of the way of the flask. After the flask full of sand is in position, air is introduced, forcing the diaphragm down. As illustrated in the second part of Fig 2 (in the cross-sectional view), the sag is always great enough so that there is still slack left in the diaphragm after squeezing the mold. This shows up as folds and leaves marks on the top of the mold. The absence of these marks indicate that the diaphragm is too small. There would be danger of bursting.

The diaphragm is never stretched. It is merely a membrane that separates the air from the sand. The air pressure is doing the work. It is the flask and the sand which keep the diaphragm from stretching and bursting.

How do you use bottom boards and weights on such a mold?

In most operations, bottom boards and weights are not used. The molds are poured in tight flasks. The strength of the sand with high pressure squeeze eliminates the need for the bottom board; clamping eliminates the need for the weights. However, there are some jobs where, because of the depth of the pattern, the weight of the casting, or the weight of the core, it is desirable to have a flat drag to set on the bottom board or pallet. In this case, we use a flask upset as illustrated in Fig 3.

The upset is usually steel. It is a removable section of the flask which stays with the molding machine instead of staying with the

Author illustrates principles of molding method which distributes pressure evenly over entire mold regardless of its size.

Diaphragm molding machine gives controllable pressures. Molding sand and diaphragm can roughly follow pattern contours.

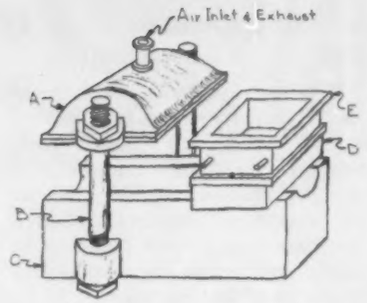


Fig 1 (C) shows rigid construction necessary. Diaphragm is contained in pressure head A. Air enters and exhausts through top of head, which is fastened rigidly to base C by tie bars B. Stress is held between A and C and is independent of foundations. Traverse car A rolls on rails of base. Flask E is on the pattern plate which is fastened to car.

flask. After molding, the upset is removed and the mold struck off along the broken line. In most cases, we don't make the upset to give a 100 per cent strike-off. Seventy to 80 per cent bearing surface is enough for most work.

Incidently, this figure illustrates a feature which surprises most people. The flask or the upset does not actually touch the head of the machine. There is a gap from anywhere from 1/8 to 1/4 inch between the flask and the head. This gap is usually kept to the thickness of the diaphragm or less.

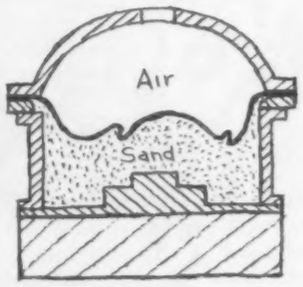


Fig 2. Top shows bottom side of diaphragm in slack position. Even in use there is slack left.

The cope can be handled in the same way. However, it is not essential to have a flat surface to set weights. In many instances, the contour top on the cope is desired in order to reduce the pouring head and thereby improve the yield on the casting. By utilizing this shorter sprue height combined with the more dense mold, operators have been able to reduce the pouring weight by 25 per cent.

Can snap flasks or pop-offs be used?

We've just discussed using an upset to get a flat bottom or top on the mold for setting weights or bottom boards. When using a removable type flask we must use an upset for exactly that reason. Such flasks require the use of bottom boards and weights. In addition, there is now a second reason for using an upset. That is to take the outward thrust of the diaphragm. If this type of load were imposed on a removable type flask it would probably break the flask or at least spring the hinges. However, by using a solid upset of the same general strength and dimension as you would use for a tight flask of the same size, all thrust is taken up by the upset itself and none is carried onto the removable flask. We have encountered no problems with either wood or metal removable flasks when the upset is properly proportioned for the job.

Can match plate equipment be used or is this all cope and drag equipment?

Match plates are not used as such. However, match plates are used commercially by using a plastic or cast semi-permanent false cope or false drag. An even more common practice is to use the match plate to convert to plastic or non-metallic cope and drag pattern equipment with its corresponding higher production.

How is the sprue set?

There are three techniques for handling the sprue. In one case, the sprue is set from the top so as to carry the taper in accordance with recommended practice on sprue design. In the other two cases, the sprue post is incorporated on the pattern plate. Incidently, anything that is said about sprue would apply equally to a riser.

Fig 4 shows a typical set sprue design and its function as related to the diaphragm. The sprue is tapered to be drawn from the outside. The upper part of the sprue post is enlarged to provide the pouring cup. The diaphragm works around this post just as it would around the pattern. It tends to wrap itself around the top of the sprue post giving a hard ram down the sprue. Before lifting the flask, the sprue is removed from the outside by hand. The top edges of sand making up the sprue cup can be knocked off quickly with the fingers as indicated on the dotted lines.

When it is desirable to set the sprue on the pattern it is not possible to incorporate the pouring cup as part of the sprue. The diaphragm wraps around the sprue post in the normal manner but there will be some sand left over the sprue post. This is taken out with a hand or power operated auger which cuts the pouring basin. In other cases, a projection or lump is vulcanized onto the diaphragm itself in such a position as to meet the sprue post and form the cup from above. In this case, there will still be some slight film of sand between the cup and the post. This can be knocked out by hand or taken care of by making the sprue post hollow and driving a jet of air up through the post to kick the sand away at the cup connection.

A lot of work is being done with a mechanical sprue with a self-expanding and retracting head to form the pouring cup.

What happens to the bars in the flask?

The diaphragm works around the bar exactly as it would work around a sprue post, riser post, or pattern. However, there are a number of things that are a little different about the barring and which should be brought out to avoid misunderstandings. In the first place, if the flask is sufficiently rigid, barring is seldom needed. High uniform mold density plus one or more sand strips is often

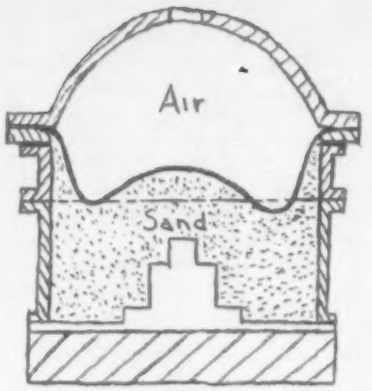


Fig 3. Where it is desirable to have a flat drag set on the pallet a flask upset is used.

sufficient. On occasions, chains are used to replace gaggers, soldiers, and arbors.

In no case, do we use an "egg crate" as you might with a lower pressure squeeze. Where bars are used, they are almost entirely for the purpose of providing rigidity to the flask. They are placed in such a position as to hold the flask walls in and eliminate the breathing which would otherwise be encountered if the flask design were too light or of a flexible design. Since we are dealing primarily in reinforcing, even large flasks tend to have only one or two bars strategically placed for stiffening the flask walls.

As illustrated in Fig 5, the recommended design for flask bar is "tear drop". These bars can be placed level with the top or dropped down below the top level of the flask. Notice that the diaphragm rests on the bar or on the sand above the bar and then tends to wrap itself around the bar. This rams the sand underneath the bar when the proper design is used. The tear drop is used to let the sand flow down around the pattern and to let the diaphragm squeeze toward the underside of the bar. Hence, the narrowing or dull knife edge at the bottom. The bar should also be rounded at the top in order to reduce the area of the point of contact between the diaphragm and the bar without actually creating a sharpness which might cut the diaphragm.

Can you use ordinary flasks or

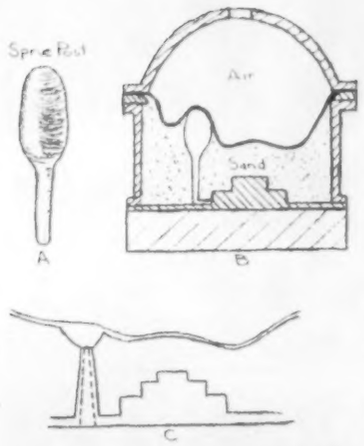


Fig 4. Typical set sprue design is tapered to be drawn easily.

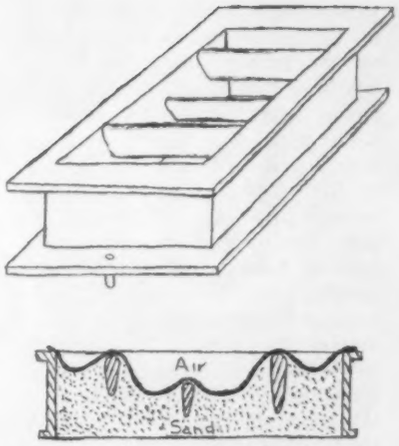


Fig 5. Recommended design for a flask bar is tear-drop shape.

are changes needed in existing flasks?

With diaphragm equipment we never recommend a light-weight flask unless the machine is operating with an upset and the upset is designed to carry the outward thrust of the diaphragm. With upsets the standard size flask can be used, even to the point of using removable or snap flasks. Where the flask is carrying the load we recommend at least a heavy duty flask. Most flask manufacturers build in at least two different weights.

The very heavy, ungainly looking flasks which are seen on occasion are for the specific purpose of eliminating all bars in very large sizes. For example, 48 x 60 in. flasks are being made without bars and without bottom boards. A rigid flask is required for this type of operation. A regular heavy-duty flask will handle most work without bars up to 24 in. square. When trying to operate a 24 x 36 in. or larger flask without any bars for reinforcing, some extra consideration must be given to flask design to develop the rigidity. The choice as to whether this rigidity should be developed in a regular flask with barring or with reinforcing of the outside of the flask depends on the value of elimination of bars.

How do you handle roll-over jobs?

Up to now this equipment has been built with either pin lift, bar lift, or roller rail lift because that type of lifting operation is most suitable where the mechanism is moved in the traverse car. The high mold density developed, together with proper flask design, has permitted us to handle such jobs without necessity for rolling over before drawing. There are obviously limitations.

The majority of work is done with a simple trunion roll-over and an overhead hoist for the drags but some of the high production work is done with automatic roll-overs on the relief conveyor.

How is the upset and strike-off handled?

Fig 6 shows the back of the traverse car (the side away from the operator). In this illustration we show a simple bar lift mechanism although the same thing would be true of the roller rail lift device. The upset is fastened to the bar lift with either one or two vertical members and a hinge. The upset moves up and down with the flask during lifting. At the same time it is fastened to the traverse car so that it can ride in and out underneath the squeeze head. In use, the cycle would start with the upset thrown back on the hinge out of the way and the flask would be placed on the pattern. The upset would then be swung down over the flask and filled with sand prior to squeezing. After being run under the squeeze head, squeezed and returned, the upset is swung back on its hinges and the flask struck off.

The excess sand can be struck off either before or after the flask is lifted from the pattern. The upset can be hinged back out of the way at either phase of the operation. The decision as to whether the strike-off before or after stripping depends on the technique used for the strike-off operation. The technique for the strike-off depends upon where the foundryman wants his spill sand to fall. If the spill sand should drop in front of or beside the molding machine, he would push the upset up and strike-off before stripping the mold. In many production operations it is desirable to remove the spill sand at another station away from the molding machine. In this case, the mold and upset are stripped from the pattern before the flask rolls down the relief conveyor to the strike-off station. Strike-off can be manual or mechanical regardless of whether it is done at the machine or on the relief conveyor.

Are special patterns used?

Special patterns are not required. The elimination of jolting plus the low pattern wear with diaphragm molding permits a wide range of pattern design and material. For example, plastics and other non-metallic pattern materials are very suitable. The contouring effect of the diaphragm does pack the sand tightly against the pattern. As a result, knicks or gouges on the pattern or slight backdrafts can create a problem. In many cases it is necessary to redress existing pattern equipment to eliminate such discrepancies which might get by in a less precise molding technique. The high pressures don't seem to involve any special considerations other than the elimination of wax fillets or other very soft pattern materials. Patterns built specifically for this method of molding would be somewhat lighter than with other practice because of the lower maintenance involved and the elimination of the necessity for heavy ribbing or reinforcing usually used to withstand the impact of large jolt equipment.

How about changing patterns and flasks, particularly in jobbing work?

Changing patterns involves no special consideration and in fact can be speeded up when properly handled. It is very simple, with straight squeeze, to rig patterns for almost instantaneous change. The patterns do not have to be firmly fastened to the traverse car or the anvil but can merely be located and stabilized through snap clamps or other fast changing technique. Anything that is strong enough to hold it down during the stripping and separate the pattern from the sand is adequate for the operation. Electromagnetic mounting of patterns is very practical.

Changing flasks is done with either a masking frame as illustrated in Fig 7 or a quick-change tank. The masking frame is merely a picture frame which is slid into the head of the machine directly under the diaphragm to restrict the diaphragm to the size of the flask that is involved. The quick-change tank, on the other hand, includes most of the pressure chamber. It is built so that the whole chamber can be slid out of the machine on rails and replaced with one with a different size diaphragm. This quick-change permits changing the

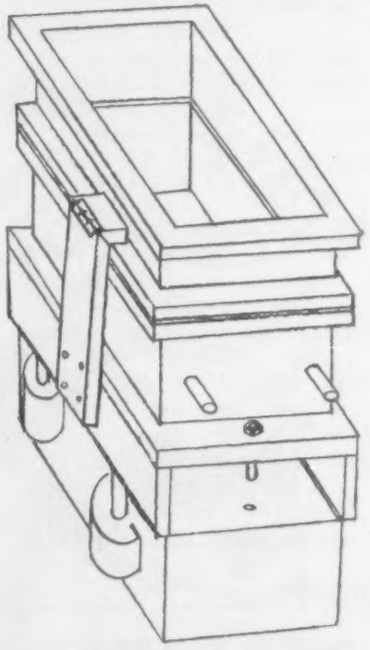


Fig 6. Back view of traverse car shows simple bar lift device.

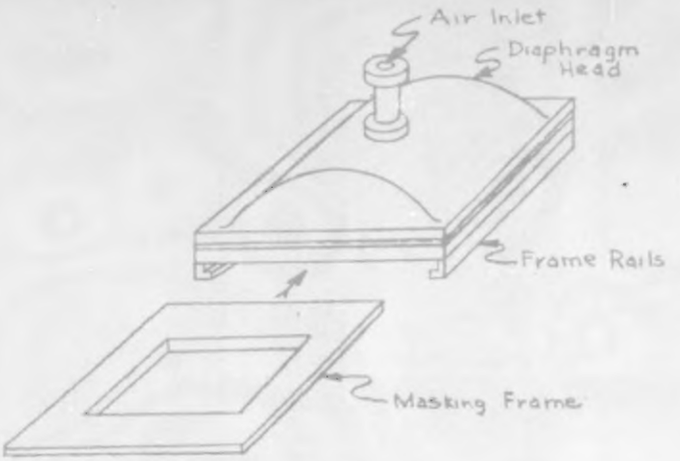


Fig 7. Changing flasks is done either with a masking frame, as illustrated here, or by a quick-change tank.

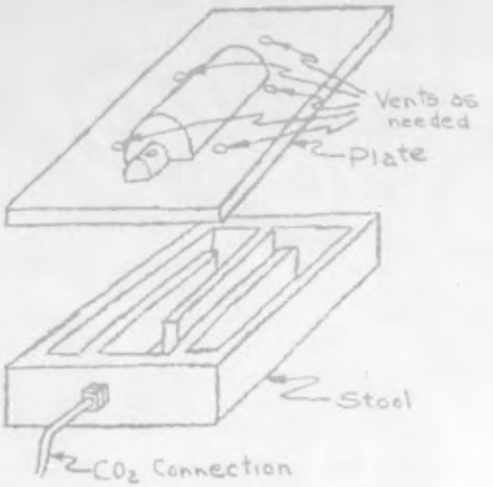


Fig 8. CO_2 can also be used with system.

entire set-up in a matter of 10 or 15 minutes. It is used primarily to change diaphragms.

The head of the machine can be raised or lowered on the tie bars for major changing in flask height. However, minor changes in flask height are made by changing the depth of the pattern stool. The machine is normally rigged to carry the deepest flask in the foundry and other flasks are handled by putting false pattern stools under the regular pattern stool so as to "jack-up" the top of the flask to the proper level. This same technique is used when cope and drag are duplexed side by side and there is a difference between the height of the cope flask and the drag flask.

What is the difference between multiple molding and duplexing?

Duplexing is used to permit a single operator to make a complete mold. This is done in a layout in which the mold is completed and closed before it goes on to the pouring conveyor. For this practice it is necessary to have a machine twice as large as the half flask and use a split masking frame. The two half flasks are set on the machine, side by side, and are molded with a single impulse of the diaphragm. The division between the two flasks is protected by the masking frame to prevent the diaphragm from squeezing down between the flasks and pinching. The same technique can be used for making two drags instead of cope and drag. The two molds can be of different patterns.

Multiple molding is an extension of the same idea except that the two or more flasks are actually joined into a single flask. For example, if we took the case where the machine is large enough to make two drags side by side, it is sometimes more logical to do it in a double flask. The flask might be built that way or it could even be constructed by welding two flasks permanently together. In this case, as in the duplexing case, of course, the pattern in each half of the flask or each section of the flask is independent of the pattern and the other half. Each would have its own sprue and risering. In most multiple molding, this idea is carried to more than two patterns. This technique permits extremely high speed molding without moving fast.

Is it necessary to change the flask depth to compensate for the squeezing down of the sand under this high pressure squeeze?

This depends upon the exact situation. In many cases, it is possible and desirable to leave the flask height alone and take advantage of the reduction in the amount of sand required per mold together with the increased yield obtained by cutting down the sprue height. However, many jobs are being made in flasks of such dimension that this cannot be done. In these cases, sand depth is controlled with a removable upset or with a permanent extension of the flask depth.

What are the air consumption considerations with this method of molding?

In general, the air consumption of a diaphragm machine is less than a jolt or a jolt squeeze machine of the same capacity. The principal difference is that the jolt machine uses up this air by taking in small increments of one jolt at a time over an interval of perhaps 10 to 60 jolts. The diaphragm machine, on the other hand, wants its air all at one time. Because of this, it is common practice to use a surge tank to avoid robbing air from the main source too rapidly. The surge tank then permits the diaphragm to work with the desirable "impact" effect. It is, of course, possible to let the air pressure build up in the diaphragm more slowly but that requires time and also loses the valuable ramming feature of the impact.

Does this hard ramming of high pressure squeeze create problems of picking up pockets?

In most cases no problem exists provided the pattern does not include minor back drafts which were not observed with prior practice. Insufficient flask rigidity, of course, might give a pocket problem by permitting excessive breathing and creating a crack at the pocket. In some specific jobs extra precautions have been taken on pockets to eliminate the need for an arbor bar when one was previously used. It is not uncommon to use a core box vent at the bottom of a pocket to break the vacuum during drawing.

Some use a rubber or compressible plastic at the bottom of the pocket for the purpose of "bouncing" the sand out during the draw. In this technique, the high pressure squeeze compresses the rubber slightly. This compression is enough to start the pocket back up as the pressure is removed.

How is the CO_2 introduced into the sand when the diaphragm principle is used for making the cured CO_2 shell type mold?

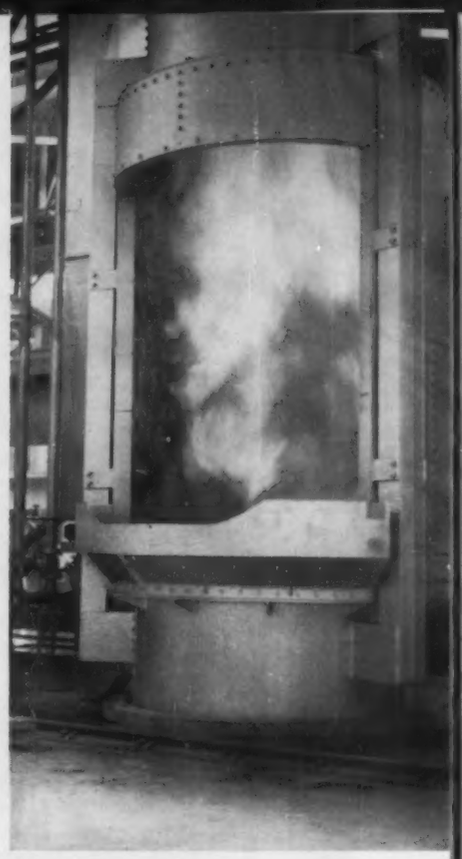
In commercial use, the easiest way is to introduce the CO_2 through the pattern stool. In this case, a simple universal gassing stool similar to a universal blow plate is mounted below the pattern itself. This gassing stool can be a hollow chamber with holes in the top or it can be a simple labyrinth as illustrated in Fig 8. When the labyrinth is used, the pattern plate becomes the top and the vents within the pattern itself guide the gas through the sand. The labyrinth or the universal stool can be permanently hooked to the CO_2 source with a flexible hose that rides back and forth with the traverse car. The introduction of CO_2 into the sand then depends entirely on where the vents are located in the pattern, and the gas moves up through the pattern through the vents into the sand.

The handling of the diaphragm principle is neither mysterious or visionary. Once the basic conception is recognized, together with its limitations and advantages, the mechanical aspects of handling the equipment in practice is logical and practical. In most cases these features are either refinements, adaptations, or direct usage of previous practices. The limitations that affect the thinking of the user are primarily of the necessity for containing and withstanding very high squeeze pressures. Equipment is designed for rigidity and strength with light weight. The advantages stem largely from the reduction of moving parts and eliminating the necessity for considering pattern wear or pattern strength.

Aerial photo of new foundry shows overall view. Present crane capacity limits casting size to 50 tons maximum.

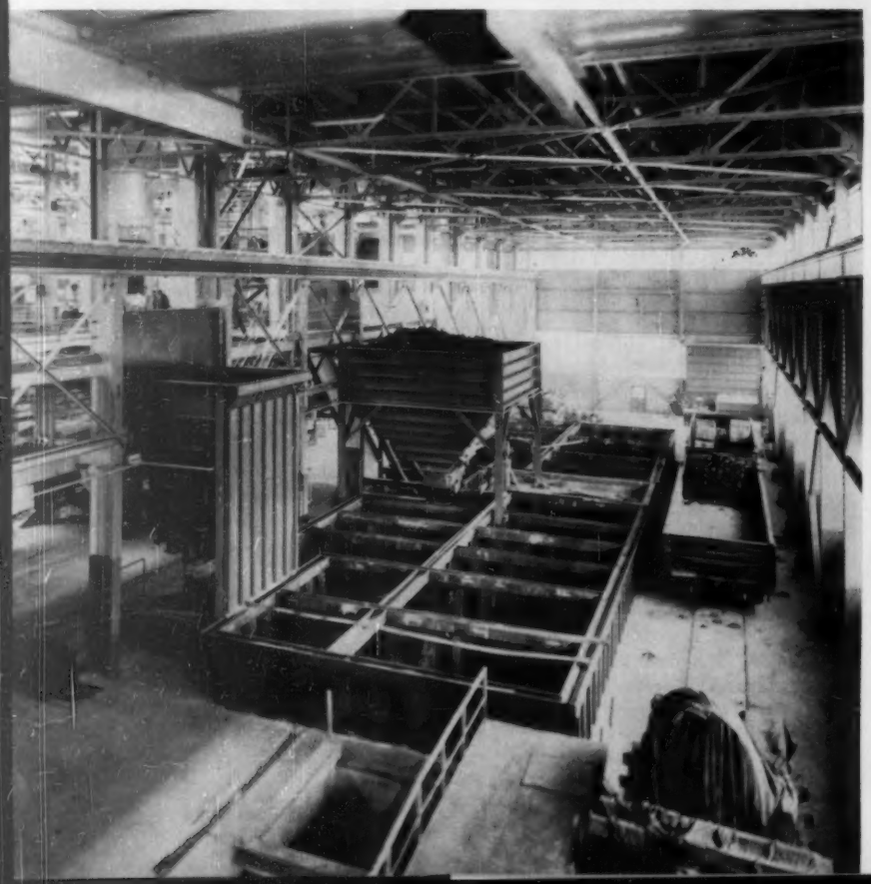
A $7 MILLION FOUNDRY

New Bullard plant has nearly quarter million sq ft. Modern materials handling systems and continuous flow production give foundry increased efficiency



Sixty-inch cupola under heat is charged by automatic system.

Inside bins store scrap iron, pig iron, sand. Large hopper in center is for coke and limestone—part of automatic cupola charging system.



Production has begun in the new $7 million foundry of The Bullard Company, Bridgeport, Conn., built to supply gray iron castings for the company's machine tools. Ground was broken for the new foundry in December, 1954, and the building was completed in April. The foundry is located within a single structure 600 ft long and 240 ft wide providing 220,000 sq ft of production, office and storage area.

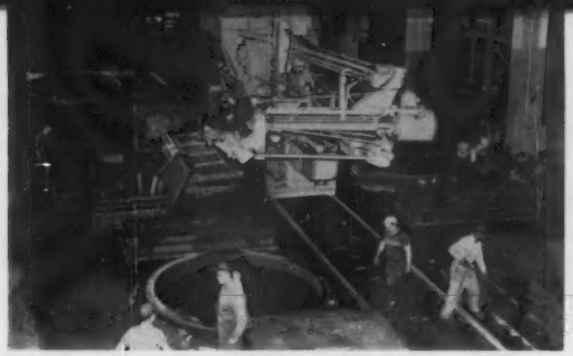
The foundry was designed for continuous flow production. Raw materials enter on the railroad siding within the building on the north side (1). Coke, sand and limestone are dumped from railroad hopper cars directly into the car unloading station (2), from which they are carried in special unloading buckets to storage bins (3). Pig iron and steel scrap are unloaded by magnet cranes from railroad cars into the storage bins.

From the bins, iron and steel are loaded in controlled amounts into the cupola charging bucket and automatically weighed (4). The bucket moves along a track where coke and limestone are fed from overhead bins. All materials are weighed and the weights recorded permanently on automatic print-weigh scales.

From the loading area, the charging bucket moves up the inclined track to the charging deck where it enters the transfer car (5) and is then dropped into the pre-selected cupola (6).

In pouring, the molten iron runs from the cupola into gas-fired movable forehearths (7). The slag drops into a stream of recirculated water in a sluiceway under the pouring spouts and is carried away underground to an outdoor settling tank.

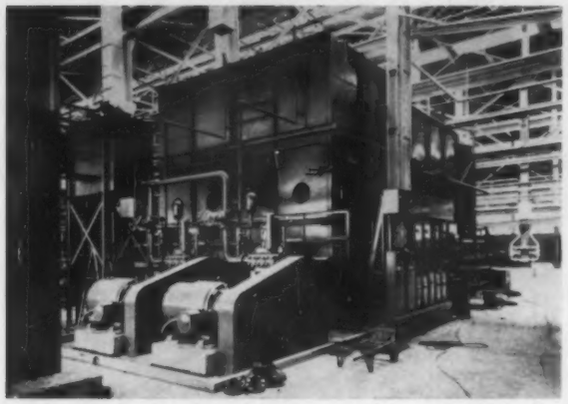
The forehearths permit continuous pouring from the cupolas and can store the molten iron between the filling of the pouring ladles, which have gas-fired preheaters (8). Four main varieties of sand are used. Large molds are made from dry sand with careful control of moisture content (9). This system also makes black core sand for large cores. The sand is carried to several discharge points: a large rollover machine (10), hoppers for



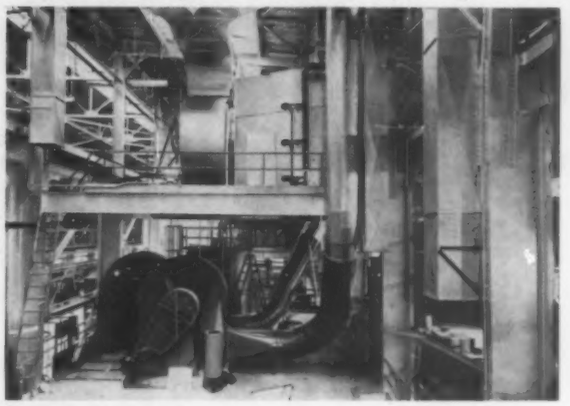
Slinger fills molds with sand at rate of one ton a minute—increasing castings production.

Gas-fired ovens have doors on two sides. Work enters on slinger side, leaves on pouring side.

Vibrating shake-out has large ventilating inlet to help reduce dust.



Hydraulic blast cleaning room has operator's platform with viewing portholes. Note pumps.



Plant has a modern ventilation system. This unit has an intake capacity of 512,000 cfm.

Cupola stacks have collectors for water spray used to eliminate dust.

slingers (11) or large cores (12).

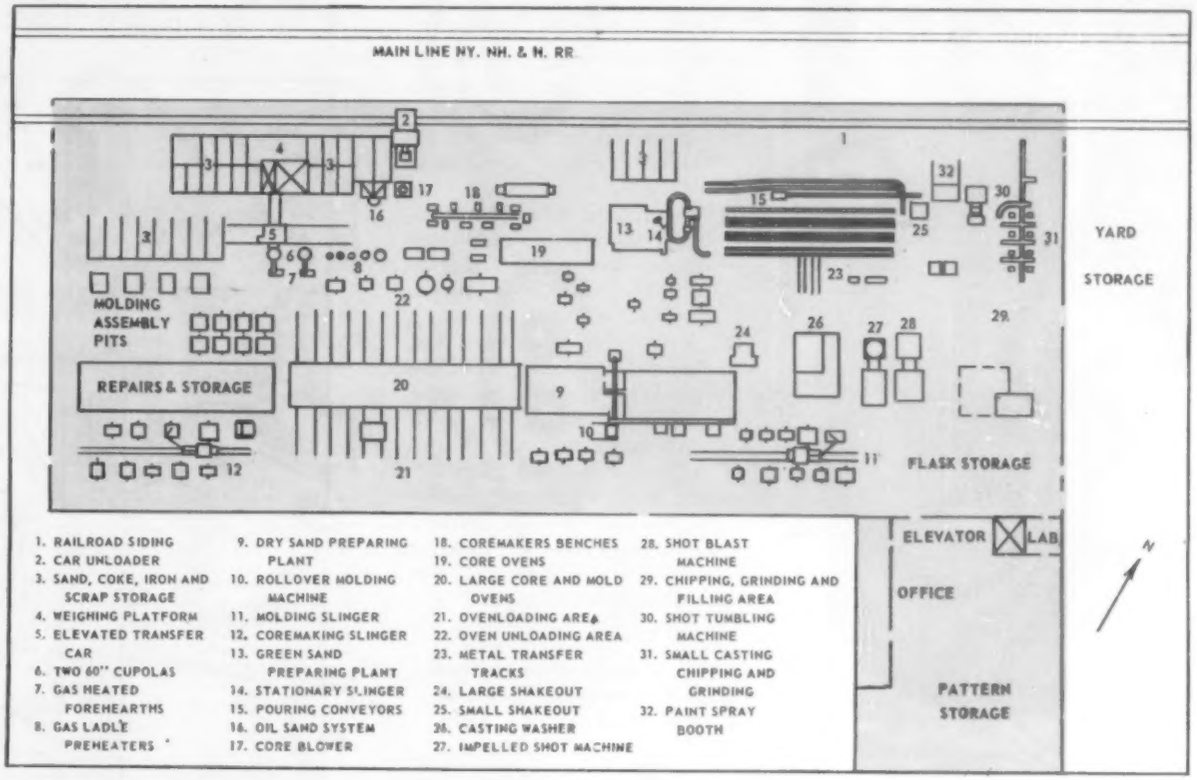
A smaller sand system prepares green sand for medium-size castings molded from permanently mounted patterns with a stationary hydro-slinger (14), and rolled onto conveyors (15).

A third sand system is for core sand (16), with cores either blown (17) or made on the bench (18), and then conveyed by slider belt to racks for loading into core ovens (19).

Large molds and cores are baked in the gas ovens (20) loaded from slinger floor (21). When baked they are unloaded from the oven cars in the pouring bay (22).

Copes, drags and cores are assembled into finished molds in the center bay and poured from ladles carried by overhead cranes. The green sand iron is carried by a side wall travel crane which can pass under the large cranes while they are pouring and make delivery via transfer tracks (23) to the green sand pouring area (15).

After pouring, molds and castings are carried to the shake-out, sand preparation, cleaning and finishing operations (24-32).



Foundry layout illustrates continuous flow production which is described in detail in accompanying article.

SURFACE FLOWABILITY—

Key to Smoother Castings

What controls casting smoothness? Experiments indicate that finishes are directly correlated with loose sand flowability.

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Fig 1. Surface flowability is measured by extrusion of sand through testing device.

During the course of an investigation on casting surface smoothness [1, 2, 3], the writers arrived at the following conclusions:

(a) The sand property which relates most closely to casting finish is the "surface flowability or loose sand flowability".

(b) Test results using the Kennedy flowability measuring device correlated directly with the amount of roughness on test castings.

(c) The AFS flowability test described in the report of the AFS Flowability Committee (1953) correlated well with the Kennedy test.

(d) A logical follow up on this line of investigation would be to find out how the surface flow properties of molding sands are related to other sand properties.

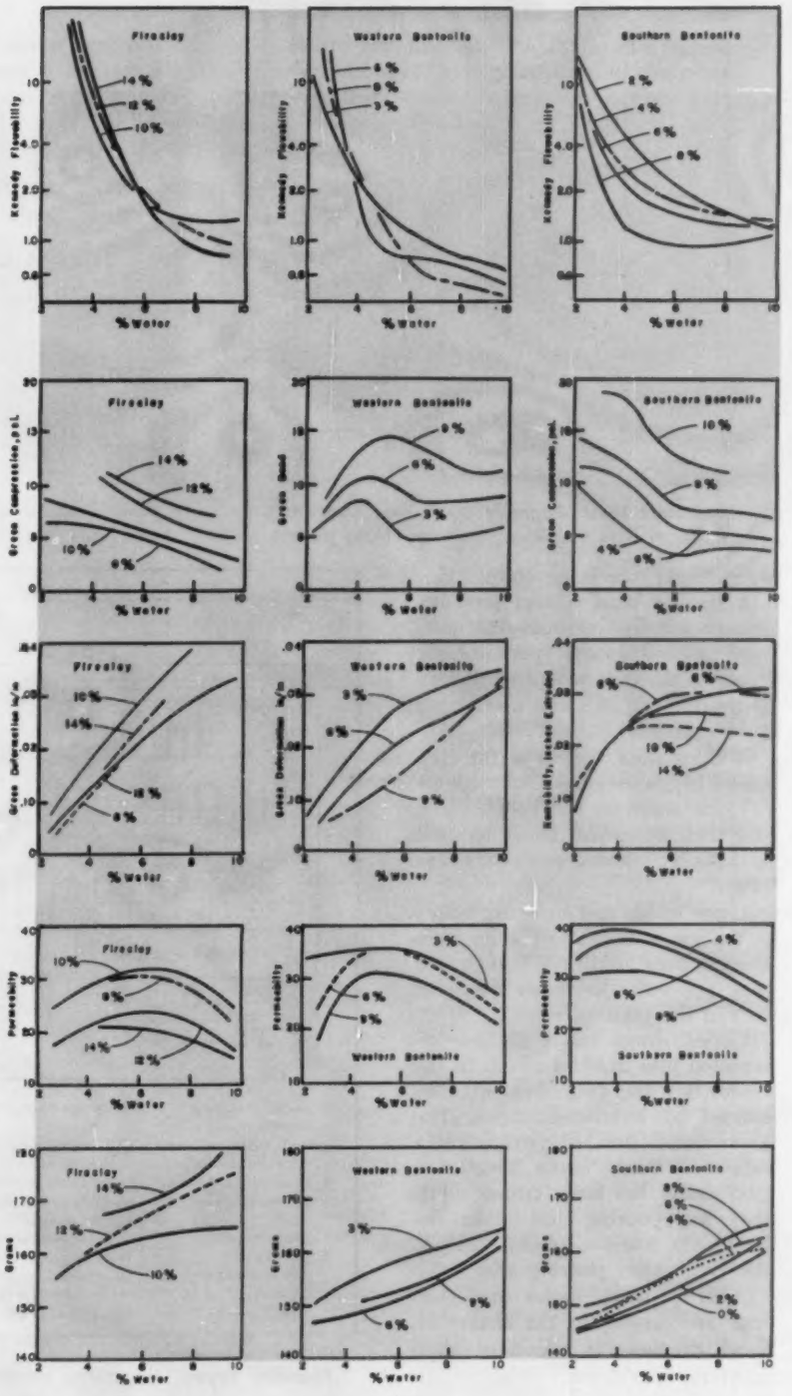

Fig 2. Characteristics of three sand mixtures are compared in the chart at the right.

Fig 3. Device measures the plastic extrusion of sand.

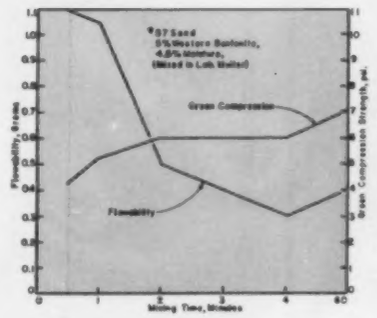

Fig 4. Mixing time tends to decrease the flowability.

Earlier work on sand flowability [4, 5, 6], has been concerned with plastic flow. Jamieson pointed out that there are two separate phenomena: loose flow of separate grains (as in an hour glass), and plastic flow of a partially compacted mass. This article deals with surface or loose sand flowability.

▪ **Methods of measuring surface flowability.** In 1953, three different methods of measuring this property were published. All three methods are satisfactory for evaluating sand mixtures. The procedures are:

Loose Flow Number 8 Gittus

1. 150 grams of loose sand are sieved into a hopper.
2. The loose sand is dropped through the air for a distance of three feet into a ¼-in. mesh sieve.
3. The weight of sand going through the sieve is the index of flowability.

AFS Tentative Flowability Test 9

1. The sand mixture is sieved into a 2-in. diameter specimen tube.
2. A weight of sand is selected that will result in the finished specimen being 2 in. high.
3. The AFS rammer weight is allowed to bear gradually down on the sand (it is not dropped).
4. The specimen is carefully stripped from the tube.
5. A visual examination of the surface voids is made.
6. A rating is obtained by comparing with standard specimens.

Kennedy Surface Flowability Test

1. A 2-in. diameter specimen tube is fitted with a 2-in. plate, leaving a circular opening 3/16 in. wide. See Fig 1.
2. Sand is sieved into the specimen tube.
3. The head of the AFS rammer is placed just inside the end of the tube and the rammer is allowed to fall freely.
4. The extruded sand is collected and weighed.
5. The weight of extruded sand is the index of flowability.

Any one of the above test procedures can be used to measure loose sand flowability. The writers found that there was a close relationship between the Kennedy test and casting smoothness. Table 1 shows some results on castings made in a laboratory molding machine. Note that with the same sand, using different additives, surface roughness of castings can vary from 0.0009 in. to 0.014 in. (standard deviation from true surface).

TABLE ONE

KENNEDY FLOWABILITY NUMBER AND CASTING SURFACE FINISH

Kennedy Flowability Number Grams	Casting Surface Finish Standard Deviation in units of 0.001 inches.		Number of Jolts
	Molding Sands	Core Sands	
0.57	14.0	—	8
1.0	10.0	—	8
1.7	4.9	—	8
2.0	2.4	—	8
2.0	—	4.4	4
2.4	—	1.6	4
3.1	—	0.9	4

For details of experimental procedure see Bibliography. (3)

▪ **Relationship of loose sand flowability to other sand properties.** In order to find the relationship of the Kennedy flowability value to commonly measured properties such as green compression strength, permeability, and green deformation, a series of sand mixtures was prepared and tested. For these tests a sand having an average grain size of 70 mesh was used.

Fig 2 shows the test results obtained.

A plastic flow measurement was also made using the instrument shown in Fig 3. This instrument measures the flow of sand at right angles to the axis of the AFS specimen tube as the sand is rammed. The results are shown as inches of sand extruded.

From these tests it is apparent that water is the main cause of low loose flowability. The more clay used, the lower is the loose flowability. As plasticity is increased, loose flowability is reduced.

▪ **Effect of mixing time on surface flowability.** Batches of sand were mulled in a laboratory mixer for periods of 30 seconds to one hour. The test results are shown in Fig 4. The effect of mixing was to lower the surface flowability and in-

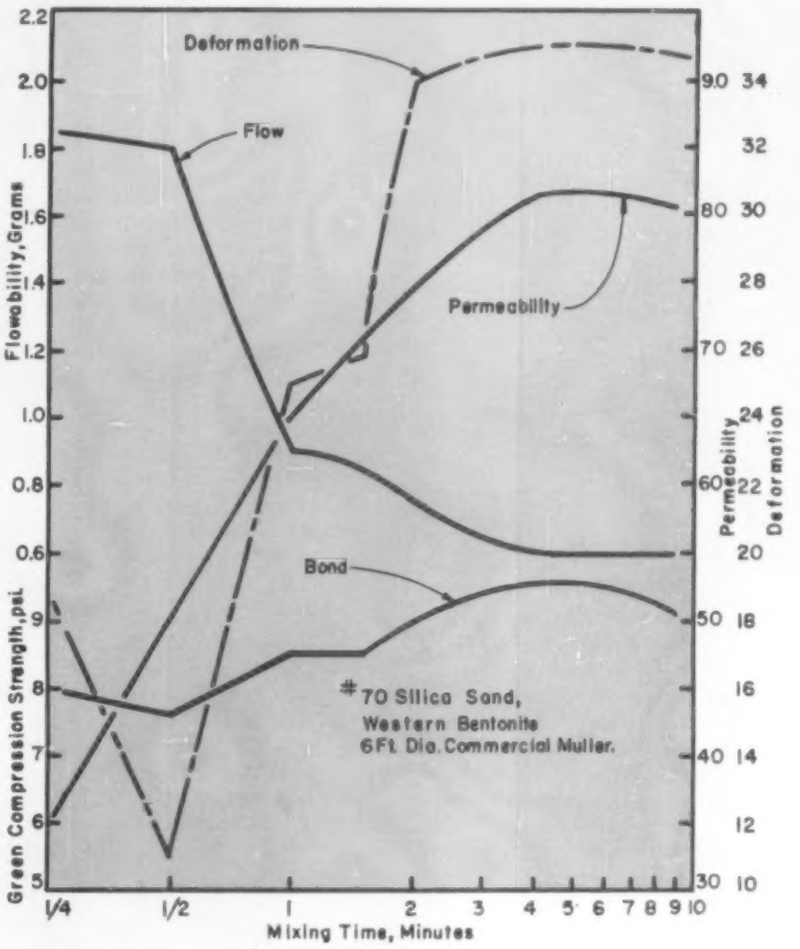

Fig 5. Surface flowability declines rapidly after 30 seconds of mixing. Western bentonite bonded sand was used in experiment.

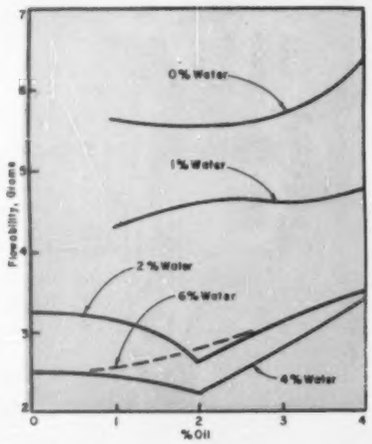

Fig 6. Flowability of core sand is effected by water.

crease the green compression strength.

A second set of tests was run on a 6-ft diameter mixer, Fig 5. Again it was found that after 30 seconds of mixing, the flowability was drastically reduced. Up to this time sand had been mulled for four minutes in the foundry in order to get the maximum green compression strength and permeability.

Mixing time in the foundry was reduced to 45 seconds. There was a marked improvement in smoothness of the surface of small steel castings. In large molds, however, the lowered plasticity of the sand made more work for the molders.

These tests explain a condition that has puzzled the writers for many years. They had observed that in many foundries where sand was mixed by hand shovel or sand cutter, smooth surfaced castings were produced. After a muller type mixer was installed, the castings produced were rough. The reason was that intensive mixing lowered the surface flowability of the sands. This situation is commonly encountered when a mechanized sand system is installed.

■ **Flowability of core sands.** Core sands generally have a higher surface flowability than molding sands and therefore produce a smoother surface. A few experiments were made to determine the effect of oil, water, cereal and clay on the flowability of a No. 70 silica sand.

Fig 6 shows that water has a very great effect in lowering the flowability of core sand. Linseed oil, however, does not markedly alter the flowability.

As would be expected, clay lowers the flowability of core sand Fig 7.

The addition of cereal (treated corn starch), Fig 8, to a core sand mixture did not affect the flowability of the sand. It did, however, reduce the permeability. It should be noted that the cereal is a gas-forming material.

■ **Practical application of flowability measurements.** The foregoing experiments were completed early in 1953. The writers decided to see if a practical application of the knowledge gained could be made. Sand control procedures were set up so as to produce sands of consistent flowability values. Moisture content, clay, and mixing times were regulated so as to maintain the desired flowability.

It was necessary to establish flowability levels which gave the best finish without retarding production. Molders wanted a stiff gummy sand which would ram with a minimum of effort. For smooth castings a dry crumbly sand is necessary. Actual practice has indicated that a Kennedy flowability value of 2.0 grams can be maintained in sand used for 50- to 500-lb steel castings. A marked improvement in casting smoothness was noticed.

Sands used for gray iron and bronze can be made with three and four grams flowability. Poor pattern equipment will necessitate the use of more plastic (and less flowable) sands.

Experience over a three-year period has shown that for the muller type mixers used the practical maximum mixing time is 90 seconds.

CONCLUSIONS

1. The smoothness of sand castings is mainly dependent upon a property of the molding material which may be called loose sand flowability or surface flowability.
2. The Kennedy flowability test has proven to be directly related to the degree of smoothness on test castings and has proved to be a practical guide in the formulation and control of sand mixtures.
3. The main cause of poor flowability in clay bonded sands is water. Also, the more clay used the poorer the flowability.
4. The surface flowability of sands is inversely proportional to the plasticity of the mixture.
5. In muller type mixers, surface flowability of sands is lowered if mixing time is more than 30 seconds.
6. A three year trial has proven that it is practical to control sand mixtures to constant flowability levels.

The authors wish to thank Neil Kennedy for his support and encouragement.

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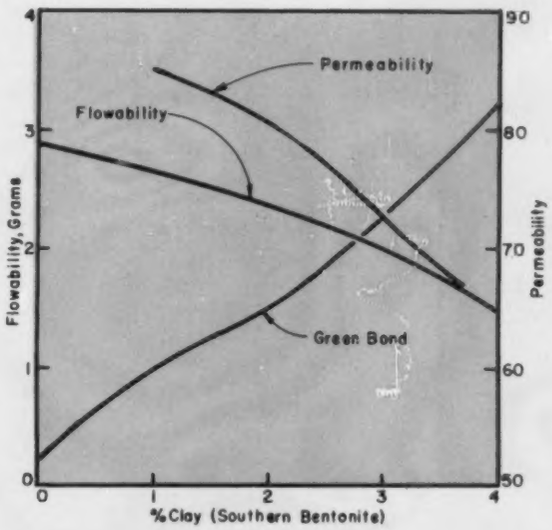


Fig 7. Clay lowers the flowability as green bond rises.

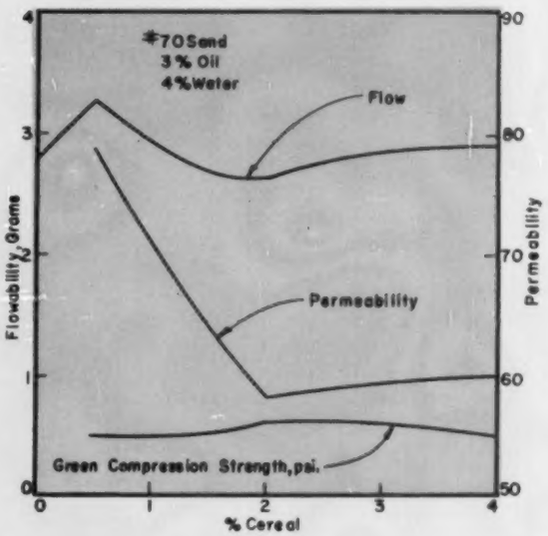
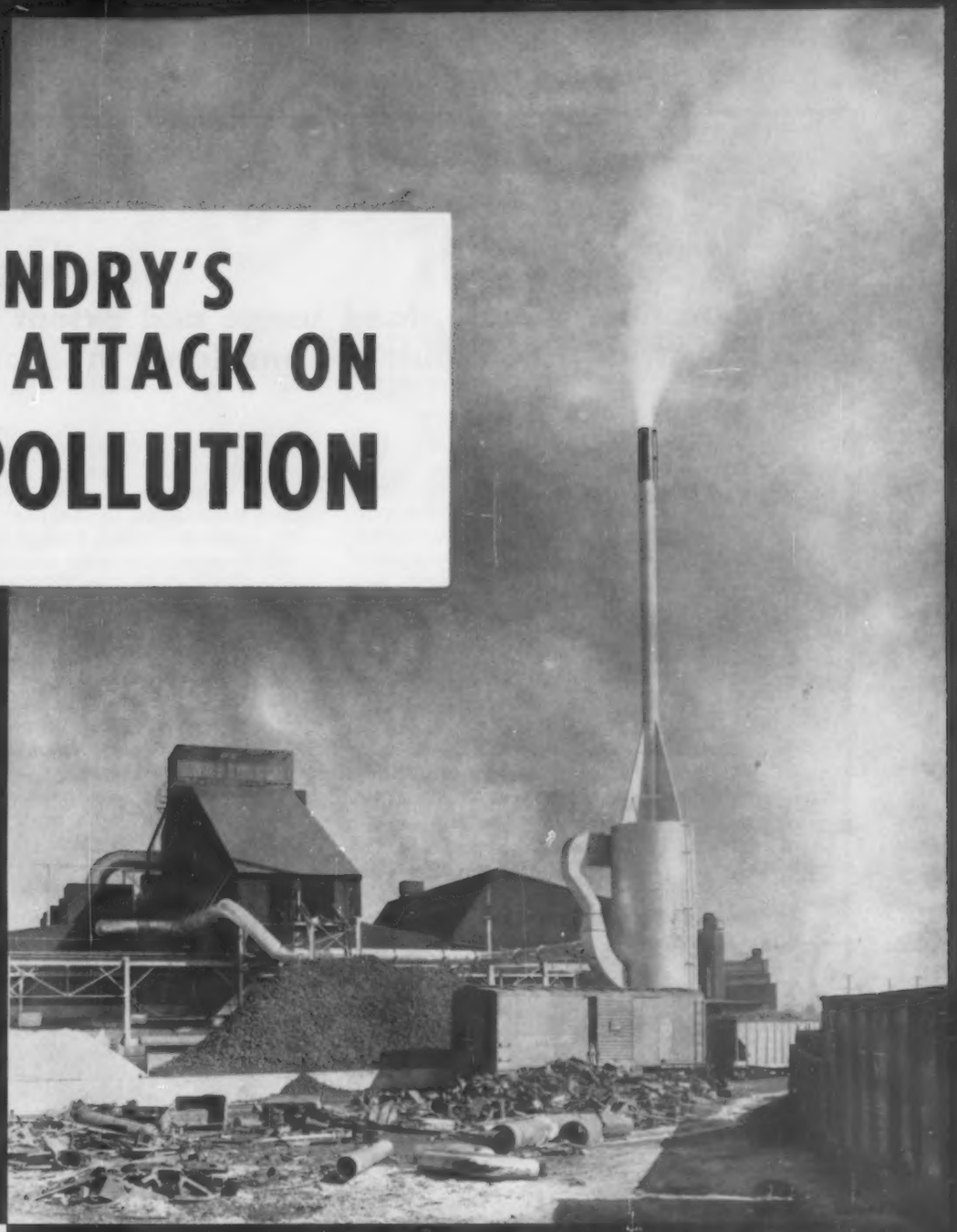


Fig 8. Cereal has no effect on flow but permeability shows sharp drop.

THE FOUNDRY'S ATTACK ON AIR POLLUTION



Air pollution can be licked, even though the answer isn't always easy. But first let's understand better just what the problem is.

A MODERN CASTINGS BONUS

This special report is another in a continuing series of bonus sections presented in MODERN CASTINGS. It is based upon a forthcoming manual on foundry air pollution control to be published by the American Foundrymen's Society.

THE LAW

Topography, climate, land usage and extent of industrialization must be considered in local laws

It is estimated that some 2000 (Table I) United States communities already have some form of specific air pollution control legislation. Most of these air pollution codes are concerned with visible emissions. Their origin dates back to early American history when residents in seaport cities brought pressure to force coal burning ships to control their emissions. Later regulations were established for the control of all combustion equipment as determined by visible smoke emitted from stacks.

▪ **The law.** In brief the fundamental basis for an air pollution law might be characterized as follows:

"Pollution of the atmosphere to the detriment of health or property shall be unlawful. This shall not be construed as contrary to the reasonable or natural use of air for dispersing waste products within the proper capacity to do so. Each localized area, i.e. one affected by the same sources of pollution, shall be considered unique, and pollution within the area judged on the basis of its specific effects. The requirements for pollution reduction and control shall remain within the bounds of scientific knowledge and economic feasibility. The responsibility for proper control of emissions shall lie with the potential offender. Where community livelihood would be adversely affected by drastic reduction of air pollution, the right of local option is to be exercised in determining the extent to which reduction of pollution shall be required."

TABLE I—Estimated Number of United States Communities Having Specific Legislation Concerning Air Pollution

Population in Thousands	Number of Communities Urban	Rural & Suburban	Total
Over 25	400	40	440
10-25	380	60	440
5-10	360	60	420
3-5	260	40	300
1-3	200	100	300
0-1	130	20	150
Total	1,730	320	2,050

The stringency of the various codes varies from the extreme of the Los Angeles County Air Pollution Control District to the indefinite and often unenforceable regulations in certain other areas. Ordinances required in these localities should not be saddled on industry where greater amounts of smoke, dust and fumes have a chance to be dispersed without difficulty. In the southwest and west gas is available for fuel and except where industrial processes create an emission problem other than that derived from the burning of fuel, local ordinances need not be nearly as stringent as they are in the localities where other fuels are consumed.

Topography, climate, type, location and extent of industrial activities are important items. Hills and wind velocity affect the rate at which air-borne particles settle to the ground. Relative humidity and barometric conditions also have a great effect upon the intensity of air pollution. Thus, one city cannot adopt the ordinance of another without first making sure that the conditions in both are substantially alike.

Where it is necessary to place restrictions on the discharge of pollutants to the atmosphere, these restrictions should be clear and specific in order to serve as a guide in the selection of control equipment. On the other hand, ordinances which leave in the hands of an individual enforcement officer the responsibility for determining what constitutes a violation in each individual case are susceptible to capricious and discriminatory administration.

These ordinances confuse the purchaser and supplier of control equipment and may discourage the installation of any air pollution control equipment or lead to unwarranted litigation costs and unnecessary, expensive equipment changes. It is gratifying to note that those responsible for the preparation, enactment, and enforcement of atmospheric pollution regulations are beginning to take into consideration such factors as land usage, meteorology and topography as well as the economic feasibility of control equipment.

THE NEIGHBORS

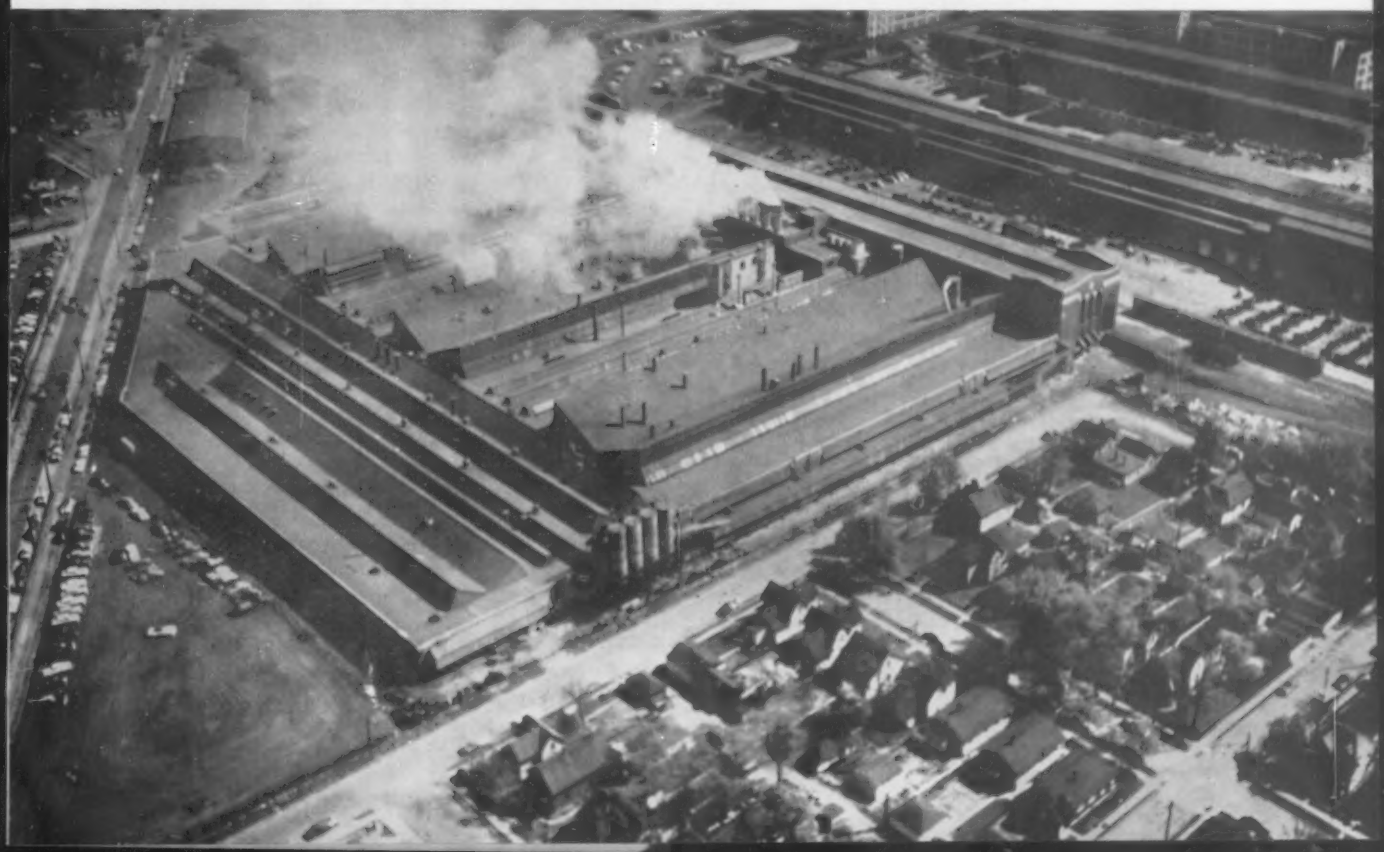
Health dangers of air pollution are over-emphasized. The problem is one of good community relations

The discharge of wastes into the air is a matter of concern throughout the country. Because of a few episodes such as that at Donora, Pa., in 1948, some persons have become genuinely concerned about dangers to health in large cities and industrial areas. Such concern has been over-emphasized. Today we see increased numbers of court actions for abatement or damages and an increase in both local and state legislation. All this represents a considerable awareness of "air pollution" by people in general and a realization that unwanted pollution can be stopped or at the least reduced materially. The predominate role of "people" in this development points to the importance of community relations in matters of air pollution.

Community relations may be thought of as the activities of an industrial management which affect the community at large and thereby influence attitudes toward the industry. In matters relating to air pollution these activities are concerned primarily with individuals and groups who live in the same geographic area—the "neighbors." But they may also involve public officials, news organizations, employees, and other industrial managements of the area.

The activities which constitute good community relations are many. Of particular interest here is the conduct of business with consideration of the rights and wishes of the neighbors. Of nearly equal importance is giving information about the nature of the company and its operation. The proper information promotes an intelligent understanding of company operation rather than a group of beliefs or suspicions. The reward of good community relations is good will and understanding of management's position and a mutual understanding of each other's problems.

There are no absolute standards to judge the acceptability of emissions. Usually the public itself decides.



The importance of community relations rests upon one fact; it is the attitude of the "neighbors" which determines whether an emission is acceptable or is excessive. This determination is a matter of personal opinion because there are no objective standards of what is or is not acceptable.

This lack of objective standards may be obvious in the case of "dirt" and of odors. Everyone recognizes a great variation in the acceptance of these on the part of different people. In the case of acknowledged damage to property, animals, or vegetation, it is the objection of people to this damage that creates the pollution problem; it is not the damage per se. Even in localities in which there is statutory regulation of discharges into the air this attitude of the people determines acceptable levels. Under present law, control regulations are frequently being determined arbitrarily; if the people are not satisfied they demand greater restrictions than are necessary or practical.

Recognizing that air pollution is a matter which cannot be ignored, management should take steps to avoid problems by keeping plant emissions at acceptable levels according to neighborhood location and to changing attitudes of people. Such positive action permits control at management's convenience, by the most practical means, and at minimum cost. In many cases the degree of control necessary for acceptance will be appreciably less than would be necessary after a problem has arisen. In the latter case a greater degree of abatement may well be required.

Of equal importance is the value of telling "management's story" to the public. Efforts at public education which show that management is honestly concerned about pollution and that emissions are restricted can be expected to gain good will. Information regarding the general nature of plant emissions, their possible effects and of what control is practical can be expected to gain understanding of management's position.

Closely related to the giving of information is the handling of personal complaints. At all costs, these should be handled promptly and with sincere efforts to supply answers. When these matters are answered properly they also gain good will and understanding. Having these, management can expect to find a higher level of acceptance of emissions, to avoid unjustified complaints and excessive demands, and to be spared highly restrictive control. It is desirable to have complaints come directly to management rather than through public officials. In the latter case they are likely to reach the newspapers, become a public matter and thereby overemphasize and magnify the problem. To encourage direct communication some companies actually canvass surrounding areas, invite questions and comments, and leave the name of a company representative who may be contacted with complaints of any kind which may arise in the future. Such personal contact may be time-consuming but it can hardly be excelled for building confidence and good will.

Finally, keeping the public informed of progress is as important as the actual installation of control equipment in handling any pollution problem. People are not analytical machines and they can judge the state of the air only by what they see, smell, taste, and feel. Changes short of complete elimination may not be recognized or acknowledged. Persons involved in a prolonged period of complaints and in court actions frequently demand drastic abatement; they may be suspicious and even vindictive. Such persons will not be satisfied simply by the installation of some control machinery. These personal aspects can be handled only by the giving of information, by explaining what has been done, by demonstrating the performance of equipment, by showing that control measures have been taken. *Without this, the installation of equipment may fail to accomplish its purpose—that is, the reduction of an emission to acceptable levels.*

At the overall community and state levels management can take additional steps separately from handling specific problems.

- **The first step** consists of efforts to obtain recognition of the industry as an essential part of the community. Within the community, specific provision must be made for industry's needs. The zoning of separate areas for industrial use is one provision to be sought.
- **A second measure** at the community and state level is participation in the development of laws. Appropriate and effective laws are obtained only when properly informed persons contribute. When industry representatives present accurately the nature of industrial pollutants and their effects, the extent of controls that are feasible, and the needs of industry, then control laws can be developed which are workable and effective. In this direction, much can be accomplished both by direct representation to those drafting laws and by participation in the public hearings.
- **Cooperation** is a necessity if any general area problem is to be resolved effectively and at reasonable cost. This cooperation is required among all public officials concerned, between officials and industry, and among the various industrial managements. Condemnation of one group by another and efforts which are at cross-purposes will not achieve results. Managements involved in an area-wide problem will be ahead to adopt an attitude of cooperation and to encourage such on the part of others.

The place of community relations in matters of air pollution may be summarized as follows. An air pollution problem is created by two things, an emission and the reaction of people to this emission or to its effects. The emission causes pollution and perhaps damage but it is the personal reaction of people which turns this into a problem for plant management. This personal aspect is of such a nature and importance as to be paramount in taking action to avoid "problems" and to answer specific complaints or to meet regulations.

THE PROBLEM

Foundries have special problems even though residences and commercial buildings cause most air pollution

Each division of the foundry industry – gray iron, malleable, steel and non-ferrous has air pollution problems peculiar in common. If the foundry industry's air pollution problems were confined to the collection of solid contaminants from shakeout and cleaning room operations, the physical difficulties involved in satisfactory collection would be minor and the financial hardship would be minimized.

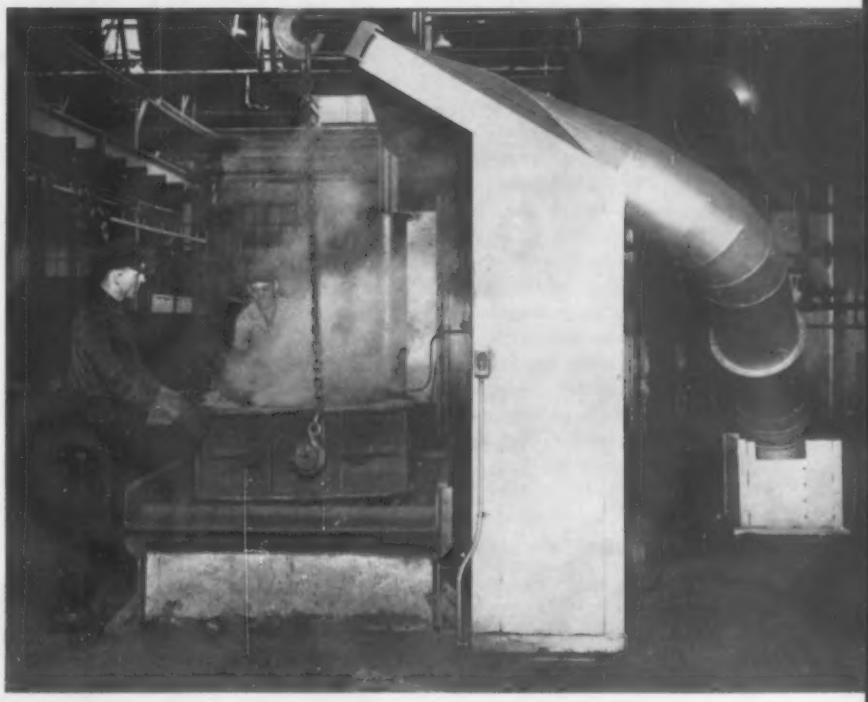
But as things stand, the cost of satisfactory collection may be prohibitive. For example, in many nonferrous shops, a large number of small furnaces are used. Because of the different alloys being melted, the operation of the furnaces may be intermittent, some not being used more than once a week. If all are connected to a single collector, needless horsepower is used during furnace stand-by time. If each furnace is connected to its own collector equipment, space and cost may be prohibitive.

Emission rates of various foundry sources vary even with the same piece of equipment. One must design collection equipment satisfactory for the highest anticipated emission rate.

Furthermore, many foundry effluents are hot and must be cooled before collection. If recirculated water is used for cooling, corrosion problems may be introduced; if fresh water, water cost may be high. Metallic oxides from melting operations are less than 0.5 micron in size, requiring very efficient equipment for collection.

■ **Sources of foundry pollutants.** For convenience, pollutants discharged by foundries may be classified as follows:

1. Effluents from dust-producing operations within the plant.
2. Odors and gaseous compounds.
3. Effluents from furnace operations.



Dust caused by shake-out is one of the special sources of air pollution from foundries. Proper collectors control this easily.

The problems arising from each type of contaminant listed above and the methods of control of pollution from these types of contaminants vary with the nature of the specific problem.

■ **Effluents from dust-producing operations.** The widespread adoption of local exhaust ventilation by modern foundries for removal of dusts and gases inside plants to improve working conditions has created a potential pollution problem which may vary from the "nuisance" stage to a general air pollution problem extending over a moderate area. It is fortunate, however, that in most foundries exhaust ventilation air is passed through dust collectors which remove the major portion of the solid contaminants before the ventilation air is discharged to the atmosphere. In fact, there is no other industry which has more universally adopted dust collectors of one type or another than has the foundry industry. Instances where dust-bearing ventilation air is discharged without cleaning are very rare.

The composition and particle size of dusts from various foundry operations will vary considerably. For example, dust from a castings shakeout is high in very fine carbonaceous material and is normally entrained in air containing appreciable water vapor. On the oppo-

site end of the scale, dust from grinding castings is composed of freshly fractured particles, along with metallic and oxide iron, clay particles, etc. Of the two, the coarser dust from the grinding operations is more easily separated from the ventilation air than are the extremely fine carbonaceous particles found in shake-out dust.

Selection of equipment to collect the given dust will depend in great part on the particle size, shape, density and concentration range of the material to be collected and on the collection efficiency desired or required by local atmospheric conditions or plant location.

■ **Odors and gaseous compounds.** Up to this time, primary emphasis in correction of air pollution for foundries has been placed on the discharge of inorganics—metal dust, sand, and fly ash—where visual inspection has shown the need for corrective action. However, even where all steps have been taken to suppress inorganic discharges, neighborhood complaints may continue as a result of disagreeable odors or condensation of oily films, with the consequent discoloration of painted surfaces.

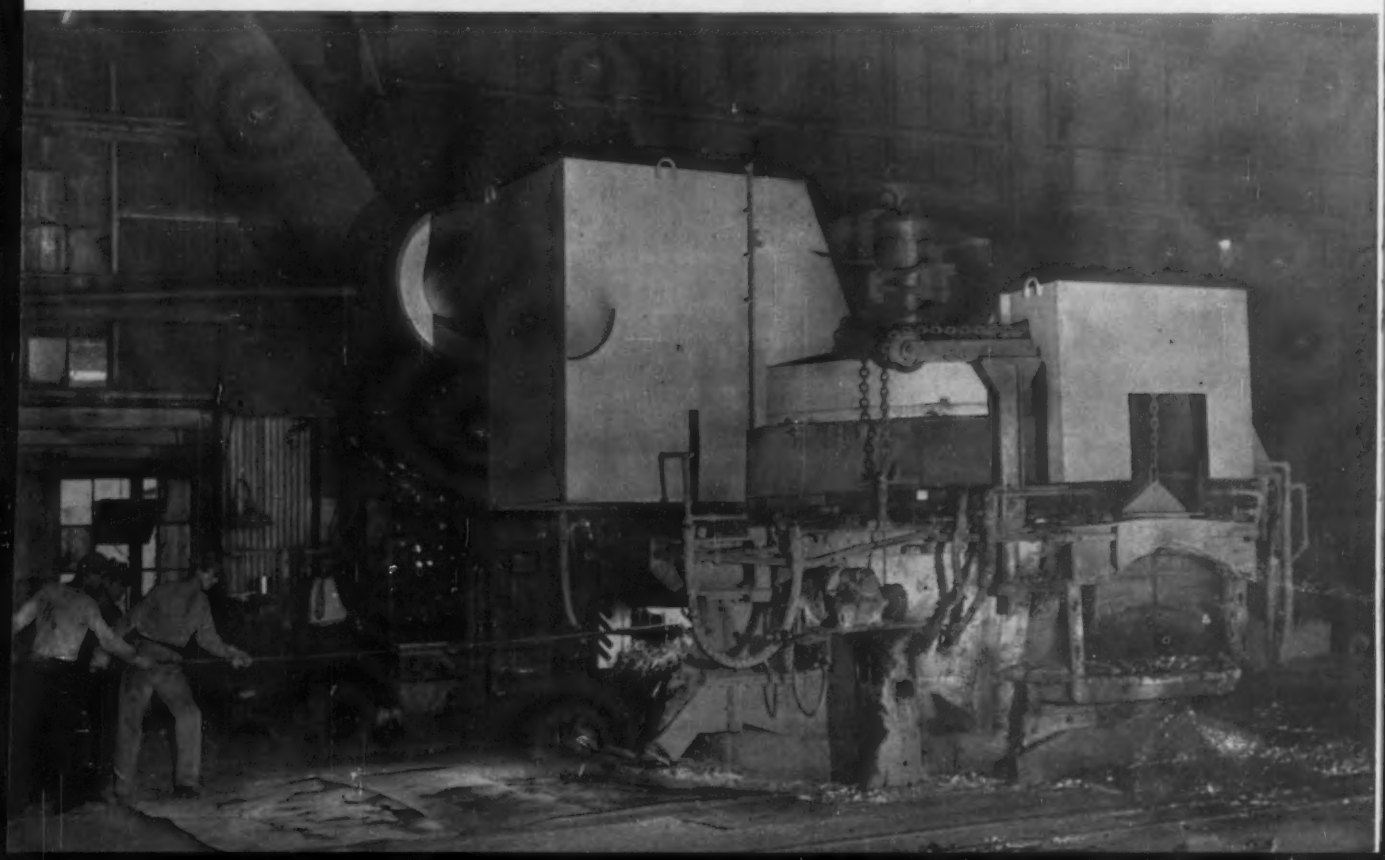
Core oils, quenching oils, resins and other organic materials required in foundry operations generally have unobjectionable odors, while retained at room temperatures. However, when used and subjected to heating, distillation and pyrolysis results in the formation of aldehydes, unsaturated hydrocarbons and other odorous compounds. Few products of complete combustion have detectable odors. The principal exception in foundry operations is sulphur. All compounds whose molecular structure consists of hydrogen, carbon and oxygen are odorless upon complete oxidation since the end products are water vapor and carbon dioxide. Consequently, to determine the source for odor complaints, primary emphasis must be placed on those foundry operations which liberate combustible type vapors, gases or mists.

The most common foundry source of vapors is the exhaust from core-baking ovens. Others include exhaust gases from oil vaporizing furnaces for metal chips prior to metal melting operations, paint-baking ovens, shell molding, oil quench tanks and draw furnaces, and core-oil vapors during metal pouring operations.

In general, the discharge of combustible fumes through high stacks has not proved successful in eliminating odor complaints. Where they have been employed in other industries there has been a reduction in intensity of odor, but at an increase in number of complainants. High stacks introduce a secondary problem of fire hazard resulting from the collection of condensate inside the stack, which frequently prevents its employment for combustible type fumes.

Destruction of the combustible fumes can be accomplished by completing the oxidation, namely, through direct combustion by heating the vapors to temperatures of

Furnace effluents are another special foundry problem. Methods of reducing this pollution are effective.



1200 to 1500 F, or by catalytic combustion at temperatures in the range of 500 to 600 F. Where concentration of the combustible matter is high recovery of the heat generated may offer opportunities for partial or full recovery of the cost of the corrective equipment. Combustion methods have their greatest adaptability on the exhaust from ovens, furnaces, and other types of equipment where the vapors are generated within confined spaces. This permits treatment at minimum initial and operating cost.

▪ **Effluents from ferrous furnace operations.** The principal types of ferrous furnace operations in the foundry industry are (a) cupolas, (b) electric melting furnaces, (c) air furnaces, (d) open hearth furnaces.

Cupolas. Over the past few years the problem of air pollution from cupolas has been given more attention than the problem of emissions from any other foundry operation. The reason for this is the complexity of the problem, the difficulty of determining the nature and amount of emissions and the moderate to high cost of equipment suitable to remove the mixture of cinders, dust, and extremely fine fume from the effluent cupola gases.

The problem of selecting gas cleaning equipment for iron foundry cupolas depends on the degree of cleaning efficiency required by neighborhood occupancy, existing pollution codes, and topographical and meteorological conditions in the surrounding area. For example, if it is merely desired to prevent the deposition of cinders and coarse dust on the foundry roof a cupola stack washer may be installed which will trap the offending material but permit the intermediate and fine solids to pass through to atmosphere.

Where a local nuisance or air pollution problem exists, it is essential to trap not only the coarse material but all of the remaining particles which could be expected to settle over the area in question. The removal of solid particles in the range of plus 2 microns can be effectively accomplished in high efficiency scrubbers. Even these devices, however, will permit the extremely fine metallic fume to escape in a visible plume which may, under certain circumstances, contribute to the general air pollution of relatively large areas.

Electric melting furnaces. The air-pollution problem from the operation of electric melting furnaces differs greatly from and is considerably less complex than that from cupolas. There is less fluctuation in electric furnace operating conditions, a factor which tends to simplify the design of air pollution control equipment.

Solid emissions from electric furnaces possess a characteristic color and appearance and are conspicuous to the eye because of the scatter of light from the extremely fine particles. To remove the solid contaminants from electric furnace ventilation air to the point where a conspicuous discharge is eliminated requires collection equipment of the highest order of efficiency, such as fabric or electrostatic collectors.

Electric duplexing furnaces. Where arc furnaces are used for duplexing, the pollution control problem differs but little from that associated with electric furnaces used for melting. The chief point of difference lies in the operating cycle which in a duplexing furnace is more nearly continuous. The emissions will contain a lesser proportion of coarse particles because of the molten charge and the absence of dirty scrap.

In many cases, a duplexing furnace is operated on more or less a "continuous pour" and the opportunity of employing an intermittent type filter is limited by the restrictions on bag shaking which, in the case of the melting furnace, may be conducted during the tapping operation and before a new charge of scrap is added. In other words, because of the somewhat different operating procedure associated with a duplexing furnace, more expensive continuous automatic equipment is necessary where cloth filters are used. Electrostatic precipitators are probably also applicable to this type of furnace.

Air furnaces. To date, air furnaces in foundries have been minor sources of air pollution with respect to the overall problem facing the industry. Where pulverized coal is used as fuel, the airborne solids discharged to atmosphere comprise mainly fly ash with only a minor proportion of metallic oxide.

Open hearth furnaces. In some steel foundries the open hearth furnace is used. From the atmospheric pollution viewpoint open hearth furnaces are characterized by wide fluctuations in dust loading, gas temperature, and gas volume during the melting cycle.

▪ **Effluents from non-ferrous furnace operations.** Much less is known about the nature of effluents from non-ferrous furnace operations, chiefly because of the minor emphasis placed on these sources of pollution to date. Because of the wide variety in melting equipment for non-ferrous alloys no attempt will be made either to classify furnace types or to treat the specific air pollution problem involved.

Brass, bronze and copper alloys. Various metallic elements contained in copper base alloys have higher vapor pressures than copper so that the composition of the fume emanating from a bath of molten alloy normally will vary according to the minor metals present in the melt. For example, fume from a brass furnace is composed principally of zinc oxide with a minor content of lead oxide, etc. Equipment designed to remove metallic oxides from these furnace gases is designed from the viewpoint of zinc oxide removal because of the predominance and peculiar characteristics of zinc oxide.

The plume from furnaces and cupolas melting brass or bronze alloys is white and usually does not arouse neighborhood complaints; nevertheless many air pollution ordinances would require collection for one reason or another. The fume is fine—of the order of less than 0.5 micron, so that only high efficiency equipment can do a satisfactory collection job. Unlike electric furnace emissions, stack temperatures from furnaces and cupolas conventionally used in non-ferrous work are too hot even for the new type fabrics; thus precooling is also necessary.

Phosphorizing of copper presents

an especially difficult problem. When molten copper is inoculated with white phosphorus, dense clouds of phosphoric acid anhydride (P_2O_5) are given off. Because the anhydride is very hygroscopic and is often used for drying gases, it would seem that a wet type collector would do a satisfactory job of fume control. However, experience has shown that scrubbing and electrostatic precipitation are necessary for foundry applications if corrosion of neighboring structures is to be avoided.

Because of the formation of concentrated phosphoric acid, scrubbing before final collection is also necessary in order to prevent excessive corrosion of the electrostatic precipitator. Stainless steel or other corrosion resistant material is often necessary in ductwork and acid-exposed parts of the system.

The collected phosphoric acid is not of sufficient purity to be marketable and the selling price of phosphoric acid presently does not justify the cost of purification.

In some areas the phosphoric acid may not be discharged into streams because of the danger of changing the natural pH of the water.

The disposal problem is probably best solved by converting the acid to calcium phosphate, a fertilizer which may be sold or given away for the cost of hauling.

▪ **Alloys of aluminum and magnesium.** Normally the fluxing agents used in melting white metal create the air pollution problem and the fume generated is composed of either chlorides, fluorides, sulphur dioxide, oxides of the alkali metals or the oxides of the material in elements comprising the melt. A whole new set of problems may be introduced by the use of fluorine compounds as fluxes in that both solid and gaseous fluorides are emitted. In normal practice these emissions are not large enough to cause a problem of themselves but complaints may arise in congested urban areas because of the total odorous and acid emissions.

The removal of solid fluorides presents no more problems than do the other solid contaminants present; however, special means of eliminating gaseous fluorides are required. Certain types of scrubbers have been effective in removing gaseous fluorides, but special construction to minimize corrosion and, in some cases, means of chemically treating the effluent water from the scrubber are indicated. It has been found that where dry type collectors are employed certain finely divided reagents such as alumina and limestone may be introduced into the gas stream to adsorb the gaseous fluorides so that the latter are removed by the dry type collector along with the solids.

In other cases, where favorable meteorological and topographical conditions exist, tall stacks may be recommended as a means of dispersing noxious gaseous compounds.

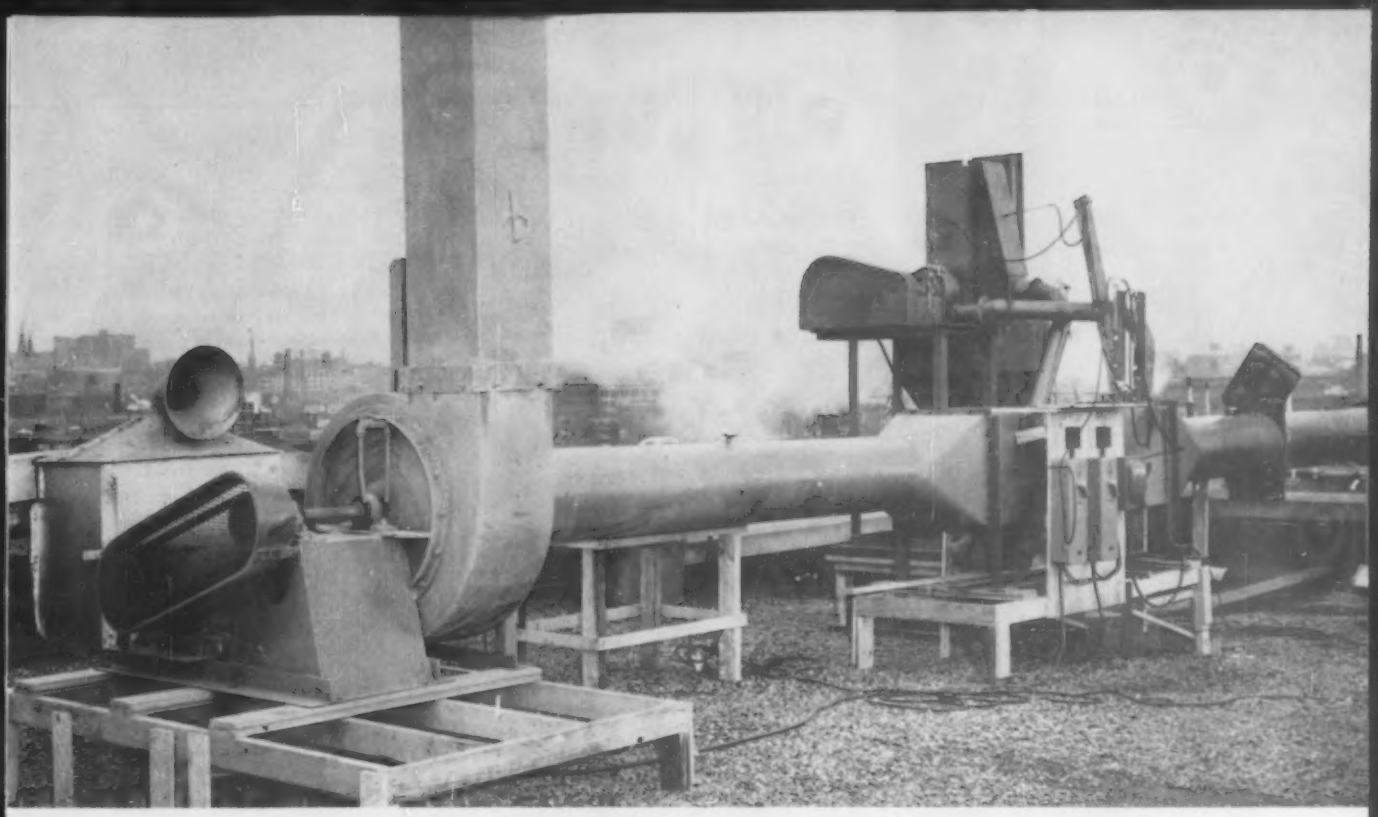
▪ **Gas cooling.** Gas temperature is one of the principal problems confronting the foundry operator who must install air pollution control equipment to clean furnace gases.

Stack temperatures as high as 2000 F are encountered in cupolas where secondary combustion occurs. Regardless of the type of pollution control equipment installed, some degree of gas cooling is required.

Since a gas cleaning system installed for air pollution abatement is usually a nonproductive expenditure, the equipment cost must be kept at a minimum. For this reason, spray cooling of hot gases is the most attractive of the available methods since it is reasonable in first cost, easily maintained, and results in only a nominal increase in the volume of gas to be filtered.

▪ **Economics.** Air pollution control equipment in the ferrous foundry industry is a nonproductive expense. In other words, the material collected from dust and fume producing operations is worthless and often requires additional expenditure for disposal. In the case of non-ferrous foundries the collected metallics may have some value, sometimes sufficient to pay for the handling of the material. In no case, however, would the value of collected fume and dust in a non-ferrous foundry be comparable to that released by primary and secondary non-ferrous smelters.

Odors and gaseous compounds also cause difficulties. Dispersal through stacks isn't enough; sometimes combustion is effective.



Example of sampling setup illustrates complexity of the problem. This is used to test cupola gases.

SAMPLING and ANALYSIS

Measurements are important but no instrument or procedure can replace the judgment of an experienced investigator

Two basic methods exist for evaluating air pollution from any source. The first relates to the measurement of contamination in the general atmosphere near the suspected source. Such measurements are conducted off the premises, normally a procedure for official agencies rather than the industry. In the second method, the dust, smoke and gas in a specific stack are measured.

▪ **Area sampling.** Particle fall can best be determined at present by frequent cumulative sampling. All samples must be collected with due consideration for the subsequent analytical procedures. If possible, the collection, transfer and transportation of samples should be accomplished without alteration from their state at the time of collection. Particulate matter may fracture or agglomerate and become greatly altered from its suspended state.

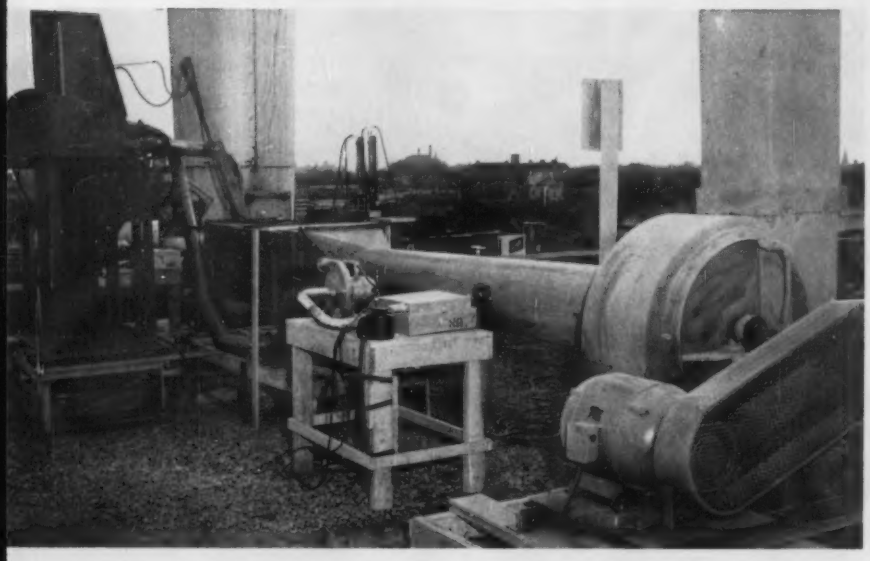
Study of average and short-time peak concentrations over an extended period of time is necessary for evaluation of pollution. Continuous short-time sampling periods are more advantageous than continuous cumulative samples, particularly since the summation of a series of the former samples can produce the data desired by continuous cumulative sampling. Even so, conclusions cannot be drawn from a few samples, even when obtained by the most skilled observer.

▪ **Meteorology and topography in air sampling.** Since meteorology and topography are important factors in air pollution they must be measured and recorded in any reliable investigation of air pollution. Otherwise the results cannot be related to recorded data in the same area or in similar areas. The results of stack sampling, on the other hand, are somewhat independent of the influence of meteorological or topographical conditions.

▪ **Wind.** The wind direction and speed as recorded by an anemometer at an elevation approximately the tops of stacks suspected of contributing pollution is perhaps the most important single measure ment. These data also give an indication of atmospheric stability so far is it is affected by gustiness.

▪ **Atmospheric stability.** Atmospheric stability determines the rate of vertical diffusion of contaminants in the atmosphere.

▪ **Temperature and lapse rate.** The decrease in temperature with elevation is termed the lapse rate and for completely mixed dry air is 5.4 deg per 1,000 feet. A greater lapse rate increases vertical turbulence and stability of the atmosphere. Stability increases with a decreasing temperature gradient. When the temperature of the air is lower at the surface of the earth and in-



Such sampling setups are costly because they are only temporary.

creases with elevation (negative lapse rate) a condition of inversion exists with a stratified nonturbulent layer of cool air lying below an upper layer of lighter warm air.

■ **Relative humidity.** Relative humidity, because of its relation to visibility and corrosion, is an important observation that should be recorded periodically. The presence or absence of fog and the amount of any form of *precipitation* is likewise of importance.

■ **Topography.** Topography observations should include not only the relation of differences in surface elevation of the surrounding area, hills and valleys and roughness of terrain, but also any nearby tall buildings and large bodies of water.

In the temperate zone, turbulence occurs mainly in the daytime and inversions at night. Inversions also are more predominant in fall.

Large particles such as cinders and fly ash are generally independent of meteorological considerations and will deposit close to their source. Gases, fumes, etc., will reach the ground at various distances from the stack, depending upon wind and atmosphere.

The stack height is related to the rate of deposition, in that maximum rate is inversely proportional to height. Normally the concentrations of dust collected by area-sampling methods are reported in number of particles per cubic foot of air, milligrams per cubic meter, tons per square mile per month or pounds per 1,000 square feet per 30 days.

■ **Stack or duct sampling.** The collection of representative samples of gaseous and particulate matter flowing through a duct or stack requires specialized equipment and procedures in addition to the knowledge and techniques employed in area sampling. Condensation in sampling lines must be avoided if sampling is to be accurate; the sampling tube must be kept above the dewpoint of any material that may condense.

In all cases the length of the sampling tube should be minimal. Wherever possible it is desirable to locate the sampler at the source, with a trap at the point of sampling. Metering devices should be located down stream, unless impractical to do so, and air flow should be measured and corrected to standard conditions (68 F and 29.92 Hg) unless otherwise specified.

When sampling mixtures of particles and gaseous compounds it may be necessary to use more than one sampling device if partition of the contaminant is desired. On the other hand, if only the total amount of contaminant is sought, a device with satisfactory collection performance should be adequate. Trace concentrations of materials generally associated with odors find the investigator devoid of scientific quantitative sampling procedures. Trained individuals nevertheless have developed a sensory response which allows them to relate odors to chemicals.

Three requirements must be met in sampling particulate matter:

1. The sample must be taken under isokinetic conditions (rate of flow and direction of atmosphere entering sample tube, same as that in stack stream being sampled).
2. The number of samples must be sufficient to be representative.
3. The long axis of the sampling head should be parallel with the direction of gas flow.

■ **Gases.** Sampling and analysis of gases in stack effluents from melting operations is seldom important in air-pollution investigations. Sulfur dioxide, hydrogen chloride and chlorine may be of some interest. Carbon monoxide may be determined by volumetric gas analysis, or diluted and measured by a carbon monoxide indicating device.

Fluorides, if present, require special consideration since they may be either gaseous or particulate, or both. Unless alkaline, they react with glass and metal. Filter-paper holders or electrostatic samples may be used for particulates and scrubbers for gases. The standard impinger may be used for either or both together, if due consideration is given the impinger's low efficiency for gases of low solubility and particulates less than one micron.

■ **Particulate matter.** Particulate matter can be collected and quantitated by any of the standard methods of collection and analysis referred to here. The method developed in 1917 by Research Corporation and revised by Western Precipitation is widely used.

■ **Particle size determine.** Particles 44 microns and larger should be separated by standard screens. Particles passing through the 325 mesh screen (44 microns) may be estimated or quantitated by one of several methods.: (1) microscope counting; (2) settling method (wet elutriation); (3) centrifuge separation, and (4) air elutriation.

BEFORE YOU BUY

Don't leap blindly. Study your problem carefully and know what you ought to do

The castings industry has such a wide range of dust and fume collection problems that in general more than one type of air cleaning device is advisable.

In addition to alleviating the community air pollution problem, air corrective equipment may be installed for one or more of the following reasons:

Prevent damage or nuisance to plant property. Process dust discharged to the atmosphere from stacks not equipped with effective air cleaning devices permits the coarser particles to settle in the general area of the stack. Such settlement can be a nuisance to the plant and many times actually causes damage from oxidation or chemical attack. The foundry cupola discharges coarse-sized emissions in quantities such that settled material on the foundry roof causes endless maintenance.

Prevent re-entry of contaminants to workroom. Air-cleaning equipment, with discharge stacks properly located, will prevent the re-entry of contaminants from exhaust systems to the workroom air. Discharged contaminants can be swirled from exhaust stacks back to the workroom through open windows and doors, or they can be picked up by fresh air supply and make-up air systems.

Reclaim Usable Material. Unfortunately, it is rare that dusts collected from foundry operations can provide a significant return in the recapture of usable material. Salvage of nonferrous grinding dusts would not justify cost of installation if the value of collected material were the only reason for collection equipment.

Reduce fire and explosion hazards. Collection of fine dust, especially from organic materials, can eliminate the fire and explosion hazards introduced by settled material discharged from exhaust systems. Combustors for the destruction of oil fumes or condensate in the exhaust of core ovens minimizes the need of periodic cleaning.

Permit recirculation of cleaned air to working space or process. With the rapid expansion in the use of exhaust systems, the large volumes of air removed from the work space have taxed heating facilities. Recirculation of air from dust collectors into the work space is a controversial subject.

▪ **Selection of dust collection equipment.** Dust collection equipment is available in numerous designs utilizing a number of principles and featuring wide variation in effectiveness, first cost, operating and maintenance cost, space, arrangement, and materials of construction. From Fig. 1 it can be noted that for certain particle sizes, application of different collector types overlaps. Factors that will influence equipment selection are:

Concentration and particle size of contaminant. Contaminants in exhaust systems cover an extreme range in loadings and particle sizes. Concentration can range from 0.1 to 20.0 or more grains per cu. ft. Mean particle size of foundry contaminants ranges from 0.1 to 100 or more microns. Some indication of the mean particle size and deviation of typical contaminants has been included in the composite chart on page 45.

Degree of collection required. A basic decision must be made concerning the type of collector needed to do a satisfactory cleaning job for the specific problem under consideration. The user should consider the need for high-efficiency, high-cost equipment, moderate-efficiency moderate-cost equipment and the lower cost primary units. If either of the first two groups is indicated the merit of combining with primary collectors should be weighed.

Degree of collection will depend on plant location, comparison of quantities of material released to atmosphere with different types of collection, nature of contaminant and its salvage value, or its potential as a health hazard or ability to damage property.

Fume and dust within foundry indicate need for collection.

Quantity of escapement will also influence the choice of equipment. For a given concentration the larger the exhaust volume the greater the need for better collection equipment. For a given dust loading, a collector of 50 per cent efficiency cleaning a volume of 1000 cfm would not discharge any more pounds of material to the atmosphere (mass rate of emission) than a collector of 90 per cent efficiency cleaning a volume of 5000 cfm.

It is recommended that a collector be selected that will allow the least possible amount of contaminant to escape and still be reasonable in first cost and maintenance. For some applications even the considerations of reasonable cost and maintenance must be sacrificed to meet established standards for air pollution control or to prevent damage to health or property.

It must be remembered that visibility of an effluent plume will be a function of the light reflecting surface area of the escaping material. Surface area per pound increases inversely as the square of particle size, which means that the removal of 80 to 90 per cent of a dust load can eliminate the coarse particles without altering the appearance of the discharge plume.

Characteristics of air or gas stream. The characteristics of the carrier gas stream may have a

marked bearing on equipment selection. The initial temperature, moisture content and the chemical composition of the carrier gas stream must also be considered in the selection of gas cleaning equipment and the manner in which it is installed.

Characteristics of contaminant. The contaminant characteristics will affect equipment selection. Chemical composition can cause attack on collector elements or corrosion in wet-type collectors. Sticky materials can adhere to collector elements, plugging collector passages. Abrasiveness of many materials like dust from sand blasting will cause rapid wear, particularly on dry-type centrifugal collectors.

Particle size and shape will rule out certain collector designs. The large size of some woodworking splinters and shavings, plus the refuse from floor sweeps, could plug the collector air or dust passages of some designs. Particles of parachute shape like the "onion skin" from soft wood planings will "float" through centrifugal collectors. Combustible nature of many finely divided materials may influence selection of satisfactory types of collectors for such products.

Disposal method. Methods of removal and disposal of collected materials will vary with the material, plant process, quantity involved and collector design. Dry collectors are unloaded continuously or in batches through dump gates, trickle valves, and rotary locks to conveyors or containers. Removal of dry materials can create a secondary dust problem.

Wet collectors are arranged for batch removal or continual ejection of dewatered material by flight conveyors or draining as a slurry. Secondary dust problems are eliminated. Solids carried over in waste water can create sewer or stream pollution problems if waste water is not properly clarified.

Material characteristics can influence disposal problems. Packing and bridging of dry materials in dust hoppers, floating or slurry-forming characteristics in wet collectors are examples of problems that can be troublesome.

■ **Dust collection equipment cost.** The variation in equipment cost, especially on an installed basis, is difficult to estimate and any figures for use as comparisons are complicated unless a thorough knowledge of the factors included or the items not included are carefully elevated. Factors which make useful cost estimates difficult to furnish include:

Price versus capacity. All dust collector prices per cfm of gas handled will vary with the volume involved. The smaller the volume, the higher the cost per cfm.

Accessories included. Careful analysis of components of equipment included is very important. Some collector designs include exhaust fan, motor, drive, and starter. In other designs these items and their supporting structure must be obtained from other sources by the purchaser. Likewise, while dust-storage hoppers are integral parts of most dust collector designs they are not provided in some types. Duct connections between elements may be included or omitted. Recirculating water pumps and/or settling tanks may be required and may not be included in the equipment price.

Installation cost. Installation cost can be a fraction of or approach the cost of the collector, depending on method of shipment (completely assembled, sub-assemblies, or completely knocked down). The cost picture can be measurably influenced by the need for water and drain supply, special or extensive electrical work, and material-handling equipment for collected material disposal.

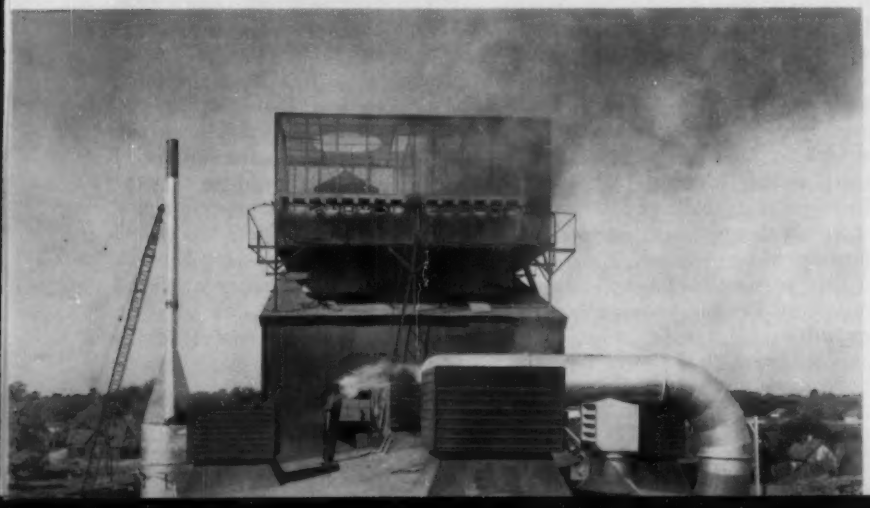
Special construction. Prices shown in any tabulation must necessarily assume standard or basic construction. Increase in cost for corrosion-resisting materials, special high-temperature fabrics, insulation and/or weather protection for outdoor installations can introduce a multiplier many times standard construction cost.

Provisions for dust disposal or salvage. Much trouble will be avoided if complete handling of collected material were considered at the time collector design and location are examined. Quantity of material will influence disposal equipment and methods. Such considerations will assure collector locations where access will be convenient and disposal practical.

With dry collectors, collected material can be discharged through dust gates, trickle valves, rotary locks or screw conveyors to tote boxes, truck bodies, or continuous material-handling equipment. Dusting will be a particular problem as particle sizes become smaller and the concentrations heavier.

With wet collection, disposal methods will be selected from sluicing of collected material to process, waste tract, or remote settling tank. Dewatered material may be handled in batches or by continuous material-handling methods. The major disposal problem will be the selection of transport equipment that will eliminate spillage.

The low-pressure-drop centrifugal collector being assembled at left will be used to cap the smoking cupola shown in foreground.



THE EQUIPMENT

Air pollution control devices have pretty specific purposes. Each type has a place where it fits best

Dust collectors are currently manufactured by 50 or more companies in the United States. Designs are varied, often employing more than one of the known principles of separation of a solid, fume, mist or vapor from a gas stream.

Most collectors can be grouped into one of the classes previously listed.

▪ **Electrostatic precipitators.** Electrostatic precipitation can provide very high dust-collection efficiencies of 90 per cent by weight or higher and with resultant air-pollution abatement up to the point of relatively clear stack discharge. All applications in the metals industry are comparatively recent and include the cleaning of cupola, open-hearth, electric-furnace and nonferrous reverberatory-furnace gases. The effectiveness of electrostatic collectors is a function of the velocity of dust-laden air passing through the electrostatic field.

In electrostatic precipitation, the gases to be cleaned are passed through a high-voltage electrostatic field formed by two groups of electrodes, the negative being charged and the positive (collecting electrodes) grounded. The gas particles receive a negative charge from the discharge electrodes and are therefore attracted to the collecting electrodes, where they are collected for subsequent disposal. Plate or pipe type precipitators are used depending on the application.

Plate Type. The basic structure (Fig. 2) of a plate-type precipitator consists primarily of a rectangular shell or casing in which a number of grounded (collecting) electrode plates are suspended parallel with each other and with equal spacing between to form ducts or channels through which the gases pass. The customary method of removing collected material from the surface of the collecting electrode plates is by a continuous rapping device.

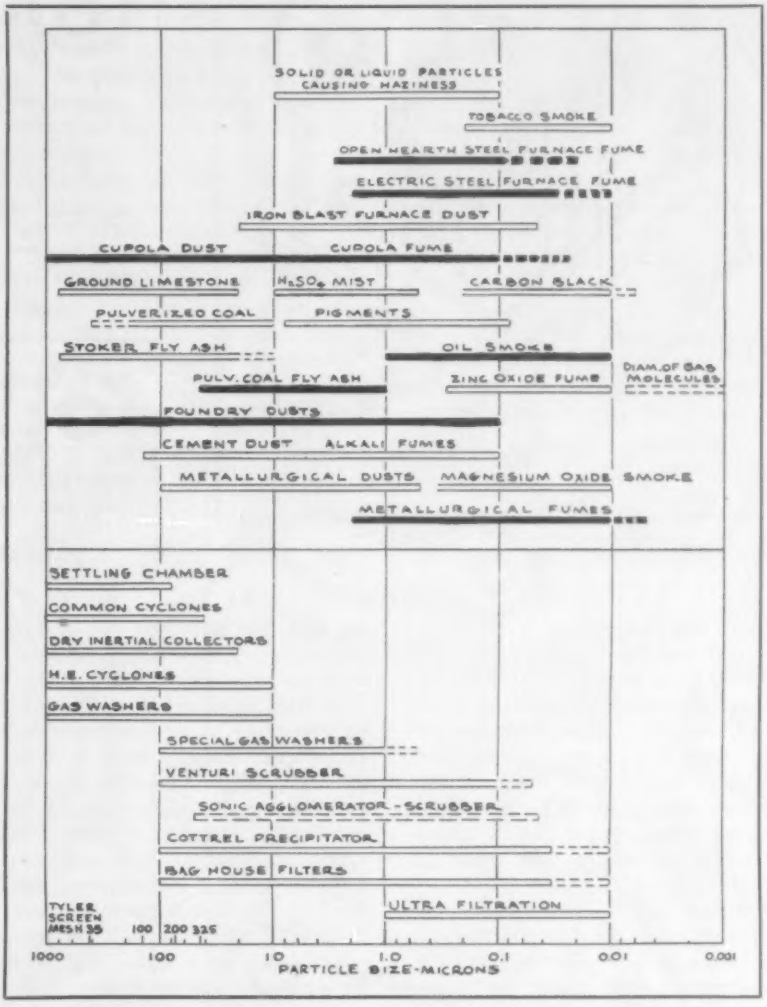
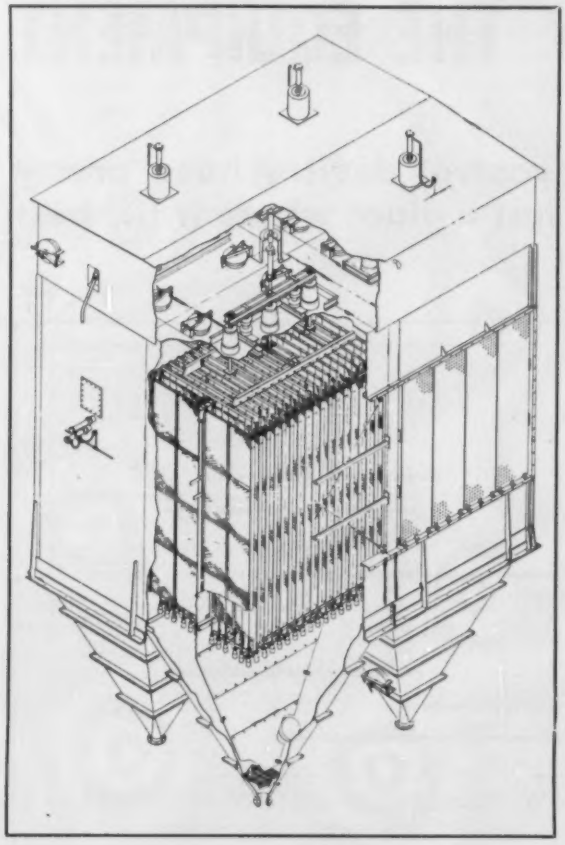


Fig. 1. Chart shows particle size ranges of dust and fumes from industry with approximate operating ranges of control equipment.

Pipe Type. The basic structure of a pipe or tube-type precipitator consists primarily of a circular shell or casing divided into two separate gas compartments by a header plate or tube sheet. In the header



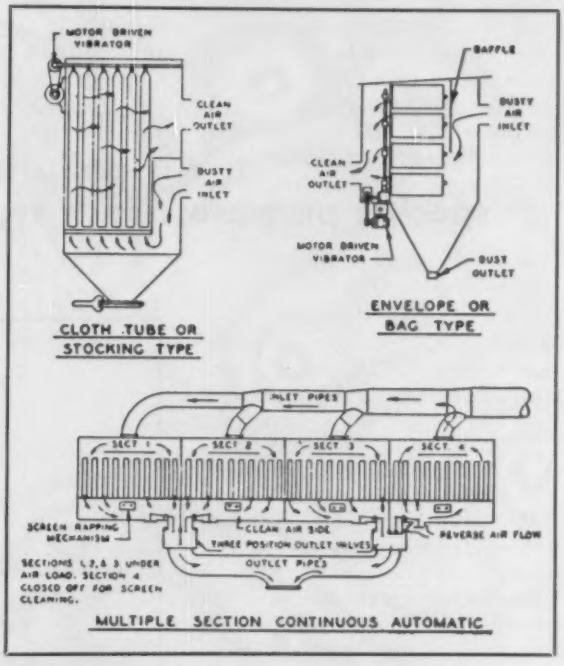


Fig. 2. Cutaway drawing shows typical plate type precipitator. Gas enters inlet (right), passes through charged electrode, and out rear. **Fig. 3.** Fabric collectors are of many types: tube, stocking, envelope, bag, continuous, etc. They can be used only in dry air conditions.

plate are suspended a predetermined number of pipes or tubes which form the gas ducts. The customary method of removing material from the surface of the collecting pipes is by water flushing. This type of collector is designed primarily for operation under pressures up to 10 psi and is consequently higher in cost than the plate-type unit.

■ **Fabric collectors.** The effectiveness of passing air or gas through a fabric at low velocity has been recognized and used for many years in air-cleaning devices. Fabric is arranged in envelope or tubular shapes as illustrated in Fig. 3. While removal appears to take place by a straining action of the media, actually, collection is obtained in arresters in this group by building up a mat of the material on the dirty air side of the media that provide the filtering or straining bed. By means of this bed a high degree of removal is obtained even on sub-micron size particles.

As dust is collected on the fabric, resistance to air flow increases. Periodically (usually on 4 or 8 hr intervals), air flow must be stopped and the arrester reconditioned by rapping, shaking, or vibrating to agitate the fabric sufficiently to drop the bulk of the adhering material to the dust hopper. Pressure drop after vibration will be considerably higher than the loss through new, clean fabric. Sufficient dust adheres to the fabric to maintain the dust mat needed for maximum efficiency.

Rate of flow through the media seldom exceeds 4 fpm and often is as low as 2 fpm for foundry service. Ratings are usually selected so pressure drop will be in the 2 to 5 in. range between start and end of a cycle. The smaller the particle, the more rapid the resistance rise for a given loading.

Fabric collectors are extensively used in the foundry and related industries for a wide range of applications. They require more space than most other types of air-cleaning devices. Erection cost is high due to prevailing practice of completely knocked down construction when shipped by the manufacturer. Variation in airflow due to pressure losses is sometimes a disadvantage and the problem of removing the collected dry dust often introduces a secondary dust condition.

Fabric collectors are limited to air conditions dry enough to prevent condensation or free moisture deposition on the fabric. With some materials a bonding tendency between particles and fabric will occur under high relative humidity even though no condensation takes place. Maximum recommended

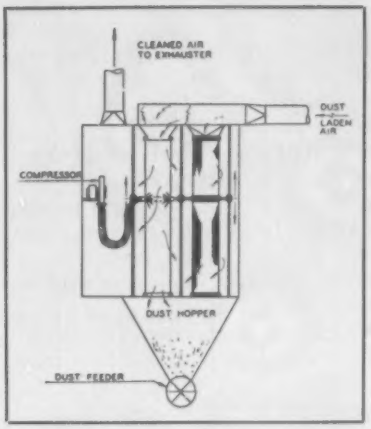


Fig. 4. Reverse-jet collector uses air jet to dislodge dust.

temperature for cotton fabric is 180 F, for wool 215 F. Higher temperature can be handled by using synthetic materials.

The disadvantages of stopping the airflow to permit vibration and the variation in airflow can be overcome in several ways. Use of sectional arresters, as indicated in Fig. 3. allows continuous operation of the exhaust system as automatic dampers periodically take one section out of service for vibrating the fabric while the remaining sections handle the entire gas volume.

Medium pressure blow back. Where screen envelope design is employed, continuous operation can be obtained by a horizontal moving mechanism that will successively block off airflow through one or more envelopes. Reconditioning is then obtained by introducing a reverse airflow through those sections. Reverse flow may be produced by the pressure differential between the outside and inside of the arrestor housing.

High pressure blow back. This type arrester was developed in the United States several years ago and is currently produced by several manufacturers. It uses high pressure air jets from a moving "blow ring" to dislodge the material from the inside of the tubular filter bag. (Fig. 4).

■ **Wet collectors.** Wet-type collectors employ a multiplicity of methods to wet the contaminant and remove it from the air stream. A wide range also occurs in their cost, pressure drop, and collection efficiency.

Wet centrifugals. One type of wet centrifugal collector relies on throwing the heavier particles against wetted collector surfaces by centrifugal force. Water rates are usually 3 to 5 gal. per 1000 cfm of gas cleaned.

Wet dynamic. The wet dynamic precipitator (Fig. 5) combines the dynamic and centrifugal forces of a rotating fan wheel to cause the contaminant to impinge on the numerous, specially shaped blades on whose surfaces a film of water is maintained by spray nozzles at the inlet. Water requirements range from 0.5 to 1 gal per 1000 cfm of gas cleaned.

Orfice types (Fig. 5). Cleaning relies on the pick up or delivery of large water quantities to a collecting zone where centrifugal forces, impingement, or collision cause

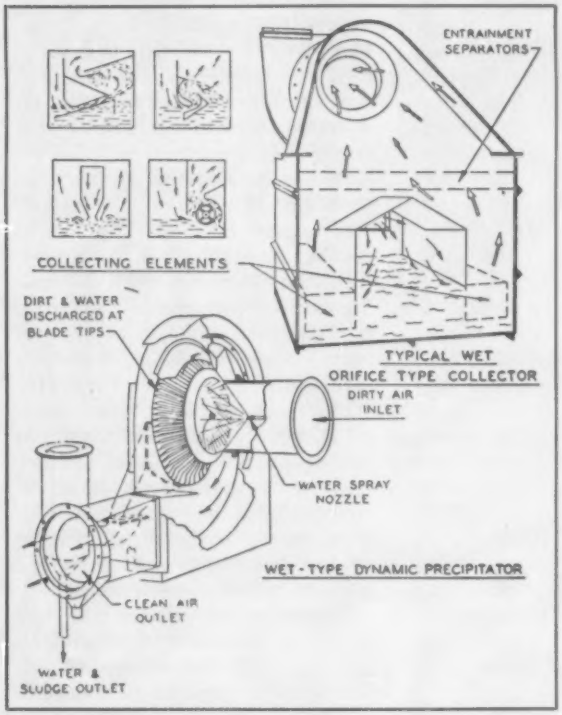


Fig. 5. View of wet-type dynamic precipitator illustrates how water is used to collect dust. Dust impinges on water-coated blade surfaces.

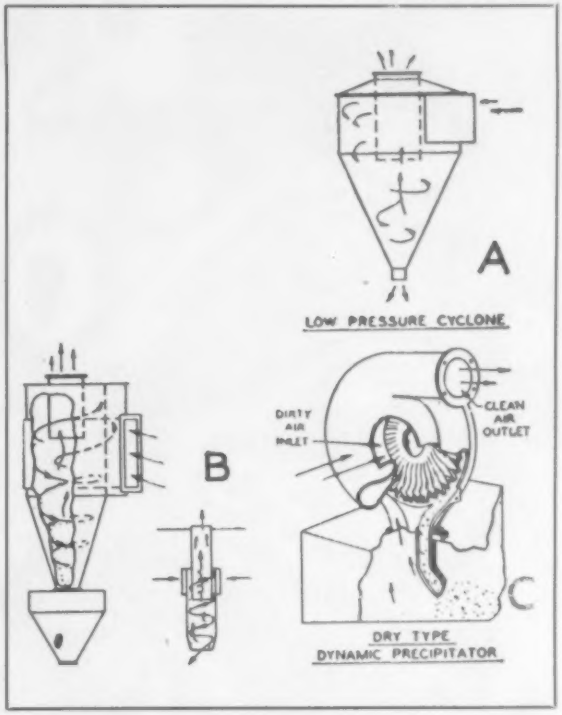


Fig. 6. Three types of dry centrifugal collectors are (A) low pressure cyclone; (B) high efficiency centrifugal, (C) dry-type cyclone collector.

wetting of the contaminant before its removal from the air stream. Water quantities in motion are high, running from 10 to 40 gal. per 1000 cfm. Much or all of this water, however, can be recirculated without the use of distribution spray nozzles or recirculation pumps.

High velocity wet collectors. The national emphasis on air-pollution control and the need for moderate cost collection equipment for submicron particles from high temperature gases have resulted in the introduction of wet collectors with improved efficiency on particles under 1 micron.

Two methods in commercial designs use either high-pressure nozzles or high-velocity venturi tubes to break down the water droplets to small size. Distribution of the droplets must be such that dispersion increases the chances of impact between water droplet and contaminant particle. The use of small nozzle orifices makes recirculation of water impractical for most industrial operations.

In the venturi design, the shear stresses of the air stream traveling at velocities of 12,000 to 20,000 fpm are used to break up water introduced through open supply pipes in the venturi throat. The turbulence in the venturi is utilized to disperse and cause impact with contaminant within a short time interval.

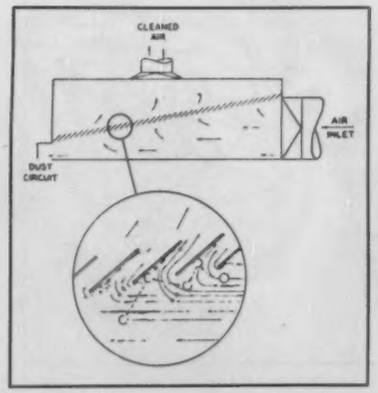


Fig 7. Louver type uses plates to change direction of airflow.

▪ **Inertial collectors.** One of the earliest dry collector designs in this group is the well-known and still extensively used cyclone (Fig. 6A) which depends on centrifugal force to spin the heavier particles against the conical section of the collector and to force it out of the dust outlet at the apex. Collection efficiency usually drops off as particle size reduces to the 20 to 40-micron range, except where very heavy concentrations are handled. Cyclones are low in initial cost and have a low pressure drop from 3/4 to 1-1/2 in.

High efficiency cyclone. Research investigations of the cyclone principle have produced a number of design modifications, some of which are illustrated in Fig. 6. By increasing the centrifugal forces available and by reducing the design faults causing dust re-entrainment, good collection efficiencies have been maintained on particles in the 10 to 20-micron groups. Collector designs usually employ a number of smaller diameter units with identical elements arranged in parallel to clean the gas volume involved. Heavy construction to withstand abrasion is typical for this group. Pressure drop will be in the 3 to 8-in. range.

Dynamic Precipitator. In this collector (Fig. 6C) dust is precipitated by centrifugal and dynamic forces on numerous specially shaped fan blades. Collected dust is forced along the blade surfaces and is discharged into a separate dust circuit within the fan housing. Collection efficiency is in the range of the high-efficiency centrifugals and space requirements are extremely small.

Louver type. Centrifugal forces can be applied to a particle by a rapid change in direction of airflow by a series of plates set at an angle to the air stream, as illustrated in Fig 7. Coarser particles traverse the air stream and are kicked back into the dirty air side by the rebound vector and the aerodynamic spin that can be produced from such an impact.

Prime advantages of the louver type of primary collector is its simplicity and low cost of construction, plus its relatively low pressure drop for the degree of removal obtained. Disadvantages are a tendency for accumulations and abrasion of the louver elements.

Settling chambers. Inertial collectors such as settling chambers and traps are not efficient. Such collectors will be effective only on large size particles or for protection of other collectors from carry-over of large, foreign objects.

▪ **Catalytic combustion.** The catalytic combustion process differs from collection type equipment so far described in that no effort is made to remove the contaminants from the exhaust stream but simply to complete the oxidation of the contaminants to odor-free and color-free, nonobjectionable gases. Since an oxidation reaction is involved, the applicability of the process is confined to combustible type fumes, gases and mists, such as the exhaust from core ovens.

The exhaust air containing contaminants is preheated to approximately 500 F and then directed through catalyst elements. Here the oxygen in the exhaust stream combines with the combustible gases to form the usual products of oxidation, namely carbon dioxide and water vapor, with a release of heat energy. The amount of heat released is proportional to the concentration of the contaminants and may in cases be sufficiently high to permit profitable heat recovery. Efficiency increases with increasing catalyst temperature, and with the type and amount of catalyst surface area available. Systems can be provided for virtually 100 per cent oxidation when needed. Theoretically the catalyst has infinite life but for usual foundry applications replacement on an exchange basis may be required in from one to four years, depending on the concentration of inorganic particles which cause attrition.

When process exhaust gases are already above 500 F, or when they contain a high concentration of contaminants (equivalent to a heat of combustion of at least 6 BTU/CF), high efficiency is obtained at moderate initial cost, with opportunity for heat recovery.

A TENSILE BAR SHELL MOLD for LIGHT ALLOYS

Having trouble with test bars for aluminum? Complications of thermal gradients and solidification rates have been met with new design.

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Frankford Arsenal

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Frankford Arsenal

With the emergence of the shell molding process as a practical foundry method, a need exists for a well-designed test bar mold. Due to the unique properties of the shell mold, the use of sand cast tensile bars is not justified. For example, the shell material has different thermal properties than green sand. This leads to low thermal gradients and associated feeding difficulties within the solidifying shell mold casting.

Thermal gradients and solidification rate, while important in any casting operation, are of particular importance in the casting of aluminum base alloys. The inherent physical characteristics of aluminum (low melting point, high thermal conductivity, and high heat of fusion) are not conducive to the development of favorable temperature gradients or solidification rates but, instead, favor the attainment of thermal equilibrium throughout the casting before solidification is completed.

It can be expected that mechanical properties of shell mold test bars will be different from those obtained in green sand. The value of these properties obtained with careful foundry practice, will serve as a criterion of melt quality when the shell-cast test bar is employed.

A test bar pattern plate employing a horizontal gating system was selected for study.

One objection to many tensile bar mold designs is that the metal stream entering the mold cavity meets within the gage length of the tensile bar. This condition can often lead to the entrapment of dross and oxides at that point which is the most critical portion of the bar.

Fluid flow principles were used to overcome this objection. By controlling the cross-sectional area of the various parts of the runner system it is possible to control the amount of metal entering each end of the tensile bar cavity without the use of chokes or similar techniques.

A good gating design should make it possible to fill the mold cavity completely with the least amount of turbulence and to maintain proper directional solidification. To accomplish this, individual portions of the system require special attention. Good gating and pouring practice require the use of pouring basins, tapered sprues, properly designed sprue bases, and streamlined gates utilizing proper gating ratios.

■ **Methods and materials.** The patterns and pattern plate were machined from aluminum with the exception of the tensile bar halves, which were machined from steel. The plate was designed so that with minor changes both the cope and drag shells could be made from the same plate. The pattern plate is shown in Figs 1, 2.

Tensile bar molds were made from a shell molding mixture having a composition as follows:

Component	Weight (%)
120-150 AFS fineness sand	94.8
General Electric resin #12368	5.0
Kerosene	0.2

One hundred pound batches of sand were mulled dry for a short period in a portable sand muller and the kerosene wetting agent added. After two minutes of mixing, the dry resin was then progressively added and the entire batch was mulled for a period of 10 to 15 minutes.

Three commercial aluminum alloys used in this investigation were 220, 195, and 40E. Spectrographic analysis of the alloys showed that they were within the allowable compositional ranges. The fourth alloy tested was a recently introduced variation of 356 alloy having a low iron content and was supplied through the courtesy of the Kaiser Aluminum Company. The nominal compositions of 220, 195, and 40E are shown in table below along with the composition of the special 356 alloy.

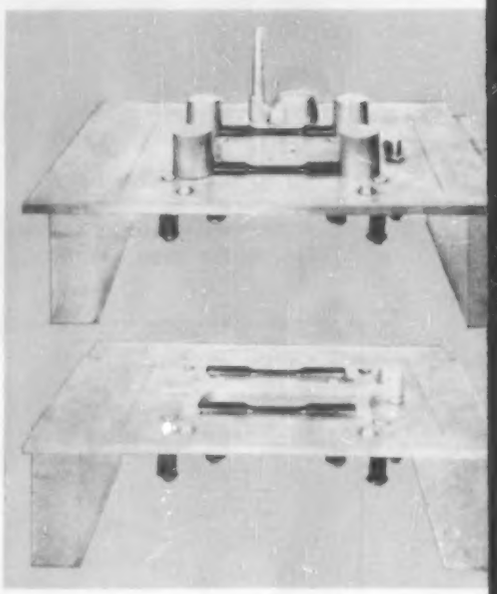
A 3000-cycle induction lift coil furnace was used for melting. Degassing was accomplished by passing dry nitrogen through the 220 and 356 alloys and chlorine through the 195 and 40E alloys for 15 minutes with the melt temperature approximately 1300 F.

The heat treatments for the alloys are shown on the following page.

■ **Results.** The original calculations of the dimensions of the sprue, runner, and gate system of the mold were based on a flow rate of metal entering the mold of 1.25 lb/sec. Subsequent measure-

Per Cent

Alloy	Al	Cu	Si	Mg	Zn	Fe	Mn	Ti	Gr	Others
40E	Rem'd	0.3	0.25	0.5 to 0.65	5.2 to 6.0	1.0	0.3	0.1 to 0.25	0.4 to 0.6	0.05 ea.
220	Rem'd	0.2	0.2	9.5 to 10.6	0.1	0.3	0.1	0.2		0.05 ea.
195	Rem'd	4.0 to 5.0	1.5	0.03	0.3	1.0	0.3	0.2		0.05 ea.
356	Rem'd	0.8	6.76	0.34	0.2	0.09	0.01	0.11		0.01 ea.



Figs 1, 2. Pattern plate is so designed that with minor changes both cope and drag shells may be made from it.

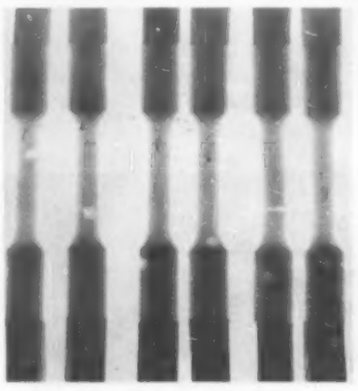


Fig 3. Vermiculite balls in radiograph indicate what happens under different degrees inclination of tensile bars.

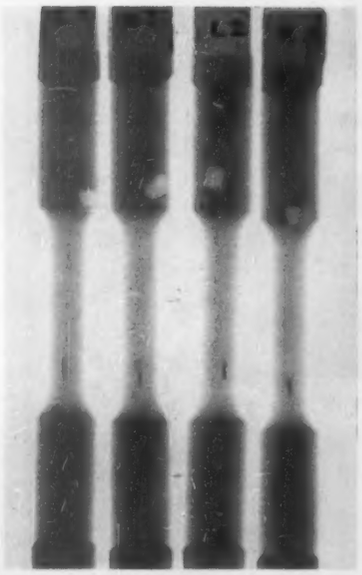


Fig 4. Adjustments have been made in gating to make metal streams meet outside the gage length.

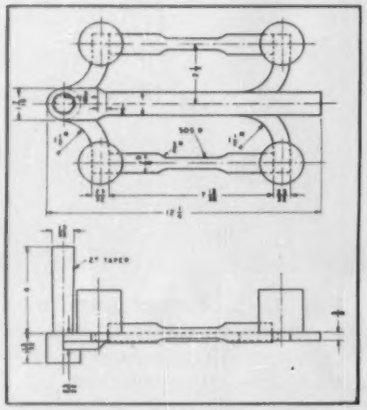
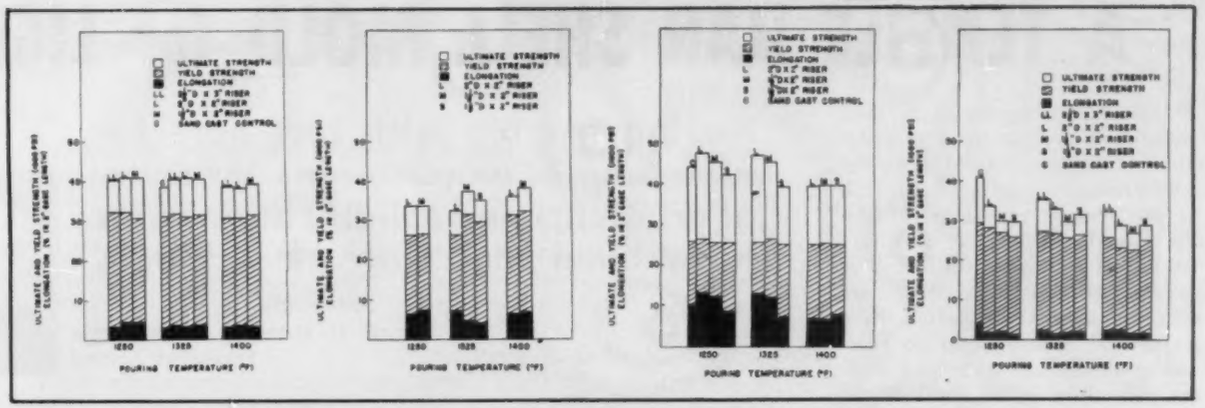


Fig 5. Final dimensions of tensile bar shell mold are shown in plans above.

Fig 6. Casting indicates gating arrangements used in tensile bar shell mold utilizing two inch risers.



Figs 7-10. Mechanical properties of alloys 356, 40E, 220 and 195 are shown with the effect of riser size and pouring temperatures. Each value on the graph represents the average of two bars from one mold.

ment of this flow rate showed that the actual flow rate was very close to the intended rate.

One of the important considerations in the design of the pattern equipment was to avoid having the metal stream meet at the center of the tensile bar. To determine where the metal streams actually met in the two tensile bars, vermiculite balls were placed in the mold cavity at the time of assembly. When the metal was poured into the mold the vermiculite balls originally held in position by fine iron wires were pushed ahead of the metal stream until stopped by the stream coming from the other direction. The castings were then radiographed to determine the location of the vermiculite balls and to show where the metal streams met.

This technique was applied to molds poured horizontally and also inclined two and four degrees from the horizontal. Radiographs of the tensile bars are shown in Fig 3. A mold inclined two degrees or more caused the metal streams to meet outside the gage length.

Adjustments were made in the gating arrangements to make the metal stream meet outside the gage length when the mold is poured level. Radiographs of the tensile bars are shown in Fig 4. The final dimensions decided upon are shown in Fig 5. Fig 6 shows a casting produced using these dimensions.

The mechanical properties of 356, 40E, 220, and 195 are plotted in Figs 7 through 10. The bar graphs show the effect of riser size and pouring temperature. A green sand control mold was poured with each alloy except 40E. These results are also included. Each value on the graphs represents the average of two tensile bars from one mold. The green sand mold had risers which were two inches in diameter by approximately 2-1/2 inches high.

In general, the properties of bars cast in the shell mold were as high or slightly higher than the sand mold control for 356, 40E, and 220 alloys. The tensile properties of shell-molded 195 alloy, however, were lower than the sand cast controls. In order to determine if the low values obtained with shell-cast 195 alloy were due to the gating, a sand mold was prepared using the shell mold gating system. Castings produced in this mold developed mechanical properties (T-6) of 39,600 psi tensile strength, 30,500 psi yield strength, and 2.7 per cent elongation. These values are of the same order of magnitude as was obtained with the sand-cast control bars.

The data obtained in this study shows that by proper proportioning of all the elements of the gating system it is possible to control the location of the junction of the two streams of metal entering the test bar mold cavity. This has been done without resorting to choking, tilting, or directing the whole metal stream through the test bar.

While the thermal gradient studies have shown that more favorable feeding conditions exist in the sand mold of standard design, the mechanical properties of the shell mold castings compare favorably with those of the sand castings. This may be due in part to the superior surface obtainable in the shell mold and to the fact that these molds are free from moisture. Elimination of the metal junction from the gage length sec-

Alloy	Solution Treatment	Quenching	Precipitation	Cooling
195	16 hrs at 960 F	Water at 150 to 212 F	4 hrs at 310 F	air
356	16 hrs at 1000 F	Water at 150 to 212 F	4 hrs at 310 F	air
220	20 hrs at 810 F	10 min in oil at 250 to 300 F; water quench at 70 F		
40E			10 hrs at 355 F	air

tion of the test bar, however, should be an important factor promoting uniformity in the tensile data.

The fact that the proposed gating system does not adversely affect the thermal gradients devel-

Fig 11. Typical cracks are shown in photomicrograph.

oped in the casting is demonstrated by the measurements made in a sand mold using the new design. The data reveals that substantially the same thermal gradients are developed in metal poured into molds of both new and standard design.

The effect that riser diameter has on tensile properties cannot be definitely established from this work. The optimum riser diameter appears to depend on the alloy being used and on the pouring temperature.

The lower properties obtained in the shell mold with 195 alloy may be due to the hot tearing tendency of the alloy. The defect shown in the photomicrograph (Fig 11) may be a result of stresses developed in the casting while a liquid phase was still present. The fact that satisfactory properties were obtained when this alloy was cast into a sand mold with the identical gating design supports this theory.

On the basis of these results it would indicate that due caution should be exercised in selecting an aluminum alloy for a shell mold casting.

Experience with 356 alloy, both in shell molds and sand molds, has indicated that while tensile and yield strengths exceeded typical values it was difficult to obtain elongation values of over two per cent. By controlling the iron and calcium contents at a low level, elongation values of three to four per cent were obtained while yield and tensile strength could be maintained at 30,000 and 40,000 psi, respectively.

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CIRCLE NO. 138, PAGE 13-14

SIMPLE TECHNIQUE Makes Shop More Efficient

WALTER A. SOKOLOSKY
Foundry Superintendent
Remington Rand
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Here's a simple system of methods engineering that can save at least 5 per cent of your foundry labor costs

It is difficult for a methods engineer to step into a foundry and pin-point the various operations that could be improved. It is difficult because the methods engineer in nearly all cases is unfamiliar with foundry practices. Consequently, in a great many foundries there has been little or no methods engineering work.

A good methods engineer familiar with foundry practice can go into a foundry and within a year improve the efficiency of the foundry by at least 10 per cent. Furthermore, he can do this with a negligible expenditure of money.

A good foundry supervisor, regardless of how demanding his regular duties are, could do nearly the same thing if he applied some methods engineering principles in his work. Unfortunately, most foundry supervisors have not had an opportunity to learn even the barest fundamentals of methods engineering.

Thus, in a great many foundries no methods engineering is being done because of limited time for training the engineer in foundry principles and too little time (and inclination) to train the foundryman in methods principles.

The purpose of this article is to point out a system whereby the average foundry supervisor, be he a group leader, foreman, or superintendent, can apply methods engineering to any of the operations performed in the foundry. This system is easy to learn and easy to apply. If applied, it will make possible at least a 5 per cent savings in labor costs in any foundry that has not previously used methods engineering techniques seriously.

The subject system can be called the "Act Breakdown" method for more effective manpower utilization. Generally speaking, we will describe a method for breaking down any operation into its basic fundamental acts. We will also show how these acts are analyzed for possibilities of improving worker output.

The Act Breakdown itself is the description of an operation using groups of movements as acts which can be followed readily by the human eye.

In analyzing any operation the first thing we want to know is "what is happening"—we must see or observe in detail exactly what the worker is doing. If we observe and study exactly what the worker is doing we are in a favorable position to help him develop a better method for his job. In order to evaluate a job or worker it is necessary to appreciate every functional detail of the operation. Every movement made is a part of the job as it exists, whether it contributes to the desired result or not.

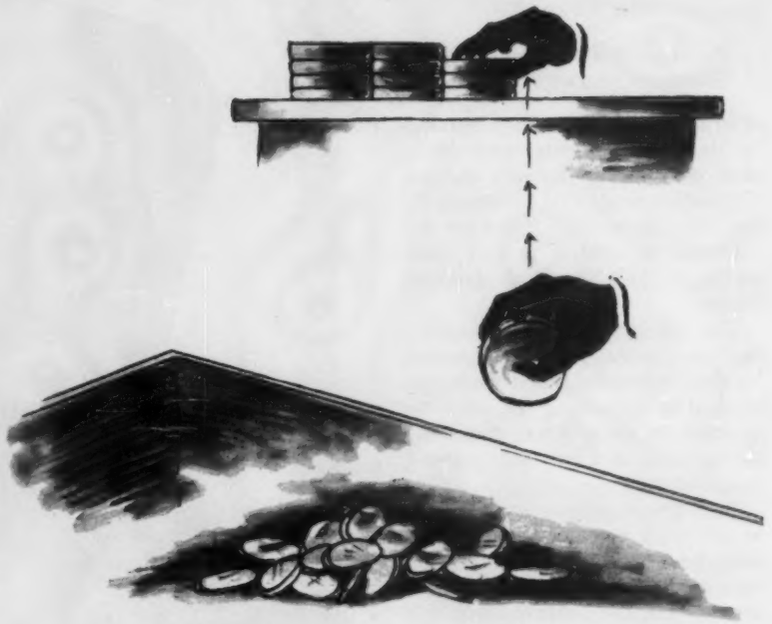


Fig 1. Get act consists of muscular work needed to grasp an object and to retain control so that it may be moved in a straight line.

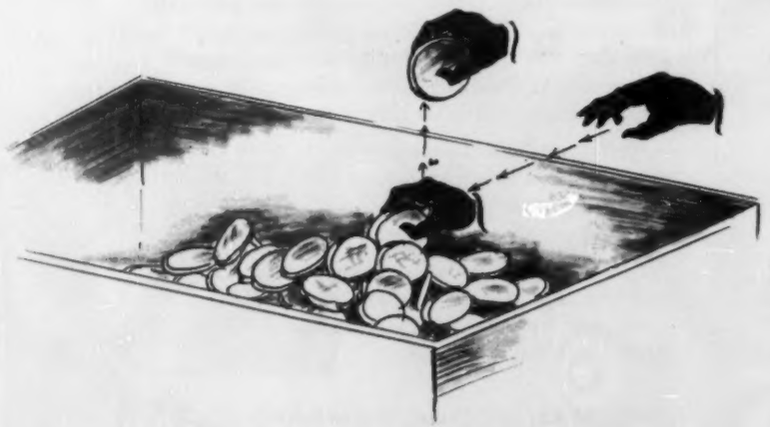


Fig. 2. Place act consists of series of movements needed to place an object in a new position and to hold or release it there.

It is necessary to establish a means of observing and recording the activity required to perform the job. Only then is it possible to examine each detail to see whether it contributes to getting the job done in the least costly manner.

There are three basic acts in performing an operation. They are:

1. **Get**
2. **Place**
3. **Dispose**

These acts should always be used when analyzing an operation. In addition, we must consider **Process** time and two undesirable factors: **Wait** and **Hold.**

The **Get** act, as shown in Fig 1, consists of the muscular movements required to move to an object and to gain control of that object so that it can be moved in a straight motion path to its next destination.

The **Place** act (Fig 2) consists of the muscular movements required to move an object into a new position and hold or release it there.

The **Dispose** act, as outlined in Fig 3, consists of the muscular movements required to move an object in a given direction and release it without reference to its position.

By **Process** is meant the application of mechanical, chemical or other means which changes the size, shape or condition of the object.

Wait is a suspension of activity

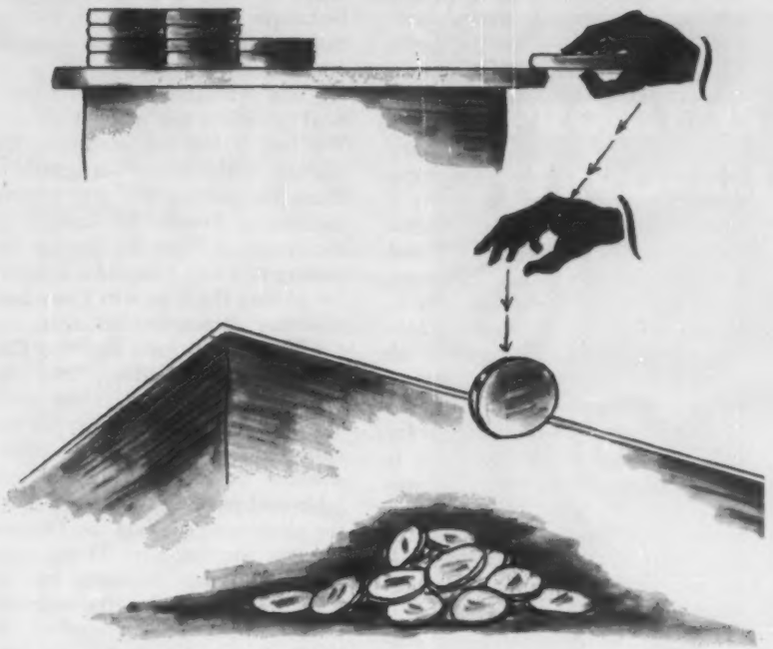


Fig 3. Dispose act has movements required to advance object in given direction and release without reference to position.

on the part of the operator for a justified or unjustified reason and may be the equivalent of one or more acts.

Hold is keeping an object in a definite position relative to another object so that the holding member does not perform any movements.

These definitions hold the key to the success of the Act Breakdown method for operation improvement. For example the **Dispose** act is simpler than the **Place** act because it is not an eye-directed movement. Whenever we have a **Place** act in an operation there is a possibility for improvement by substituting a **Dispose** act for it.

Whenever the **Process** time influences the overall cycle because the operator has to wait there is a possibility for improvement.

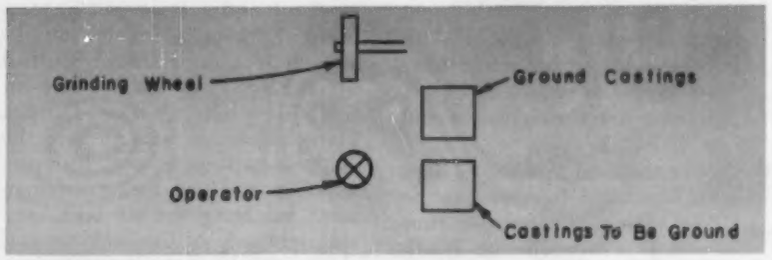
Waiting is wasting time and whenever we have it in an Act Breakdown we should suspect an improvement possibility. Any suspension of action is undesirable and should be corrected. We do not classify **Wait** as an act because it does not describe any muscular activity.

Hold is the twin brother of **Wait** and it is equally wasteful.

With these definitions and explanations to go by it is possible to break down any operation in a systematic manner. The most positive way to do this is to chart or log the activity of the operator. As long as both hands are available for an operation we should log each hand's activity.

As a sample to show the application of the Act Breakdown technique let's look at an operation for grinding the gate off a small casting. The operator's work layout might be as shown in the sketch in Fig. 4.

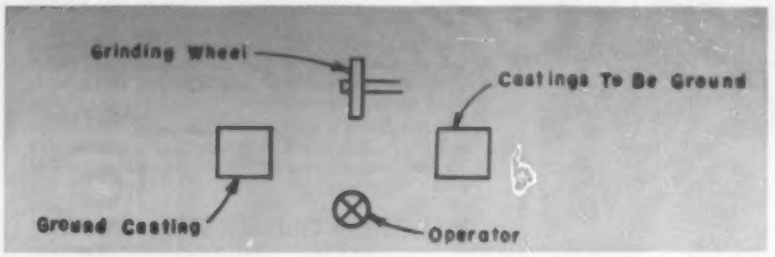
Normally we could describe this operation by stating that the operator takes a casting from the tote pan, grinds off the gate, then puts the ground casting into another



BEFORE (Fig 4) using act breakdown this operation consisted of four movements for each hand which indicated unbalanced activities.

Fig 5 (below) shows chart of the activities as diagrammed above.

STEP	Left Side			Process	Right Side		
	Explanation	Object	Act		Act	Object	Explanation
1			Wait		Get	Casting	From tote box
2			Wait		Place	Casting	Against Wheel
3	Against Wheel	Casting	Hold	Grind	Hold	Casting	Against Wheel
4			Wait		Dispose	Casting	In tote box
		Repeat		Sequence			



AFTER (Fig 6) by eliminating two time-consuming and non-productive acts production was increased—and with no financial expenditure.

Fig 7 (below) shows how new procedure appears in act breakdown.

STEP	Left Side			Process	Right Side		
	Explanation	Object	Act		Act	Object	Explanation
1	To tote box	Casting	Dispose		Get	Casting	From tote box
2			Wait		Place	Casting	Against Wheel
3	Against Wheel	Casting	Hold	Grind	Hold	Casting	Against Wheel
			Repeat	Sequence			

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tote pan and repeats this sequence until all the castings are ground.

Using the Act Breakdown method we would describe this operation by using the form as shown in Fig. 5.

It should be obvious how very clearly the Act Breakdown form depicts an operation. It shows a total of eight steps in this operation—four for the right hand and four for the left hand. However, there are only three basic acts in the operation. There are two **Holds** and three **Waits.** This shows an unbalanced activity as far as useful acts are concerned.

An easily observed indication for improvement in this operation is to replace the **Waits** with some useful productive acts. Obviously the **Holds** and **Process** are necessary parts of the operation. The room for improvement clearly lies in reducing the number of **Waits.**

One apparent method for correcting the unbalanced activity is to put the ground castings tote pan on the left hand side of the operator. Then the left hand could be disposing a casting while the right hand was getting a casting. With this revised layout we would have a work layout as shown in Fig. 6.

The new Act Breakdown would be as in Fig. 7.

Notice the total number of steps for the operation has been cut to six. We have eliminated two time consuming, non-productive **Waits.** We have provided a better balanced operation. The operator is able to grind more castings per unit of time without working any harder than he did before. Of particular importance—not a cent was spent to get this improvement.

As a matter of interest we found a case in our foundry similar to the above. The actual saving on a small casting amounted to reducing the grinding costs from 0.151c/hundred to 0.123c/hundred. Percentage-wise this amounted to a savings of approximately 18 per cent.

Of most importance, however, in this sample Act Breakdown is the fact that with the graphic layout of the operation and utilizing the fundamental act terminology it was clearly indicated where an improvement could be made.

Another example of savings made by using the Act Breakdown technique for operational evaluation took place at the cutoff saw in our aluminum foundry. When the job was evaluated it was not practical to reduce the number of acts. We had a **Get** for obtaining the casting with sprues attached, a **Place** for putting the unit against the saw, a **Process** for cutting off the sprues, a **Place** for putting the casting in a tote box and a **Dispose** for putting the sprues in a tote box. However, it was evident from the Act Breakdown form that the **Dispose** act was a relatively long portion of the operation as the operator had to turn around to put the sprues in the tote box. By installing a chute on one end of the saw table and pushing the sprues down the chute into the box the **Dispose** act was shortened by 33 per cent. The cutoff costs, averaged out for a number of small parts, were reduced from 0.365c/hundred to 0.342c/hundred or a 6.3 per cent total saving.

The Act Breakdown can and should be used for all operations in the foundry from molding on down. In a semi-production jolt-squeeze molding operation we had a **Get-Place-Place** for blowing off patterns with an air hose. The last **Place** had to do with putting the air hose back on a hook. By using a pulley and coil spring arrangement we hung the air hose over the right side of the molding machine. With the rearrangement, when the molder was through with the air hose he just let it go instead of placing it on the hook. We substituted a **Dispose** for a **Place.** Just this small change in movements amounted to a time saving equivalent to three extra molds daily for the patterns in consideration.

There are so many physical movements in any foundry operation that if only a few of the **Waits** are replaced by useful acts and if only a few of the **Places** can be replaced by **Disposes** there will be a profitable improvement in the foundry. To a methods engineer the Act Breakdown is only one of the many methods that can be used to improve worker output. To a foundry supervisor, however, the Act Breakdown can be, on its own, a very useful tool.

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■ New officers have been elected by many of the chapters of the American Foundrymen's Society, included in these are the following:

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Directors: R. Nye, Fred Nye Foundry, Vancouver; C. Rowe, Crane Ltd., Calgary: G. L. Young, Canada Metal Co., Vancouver.

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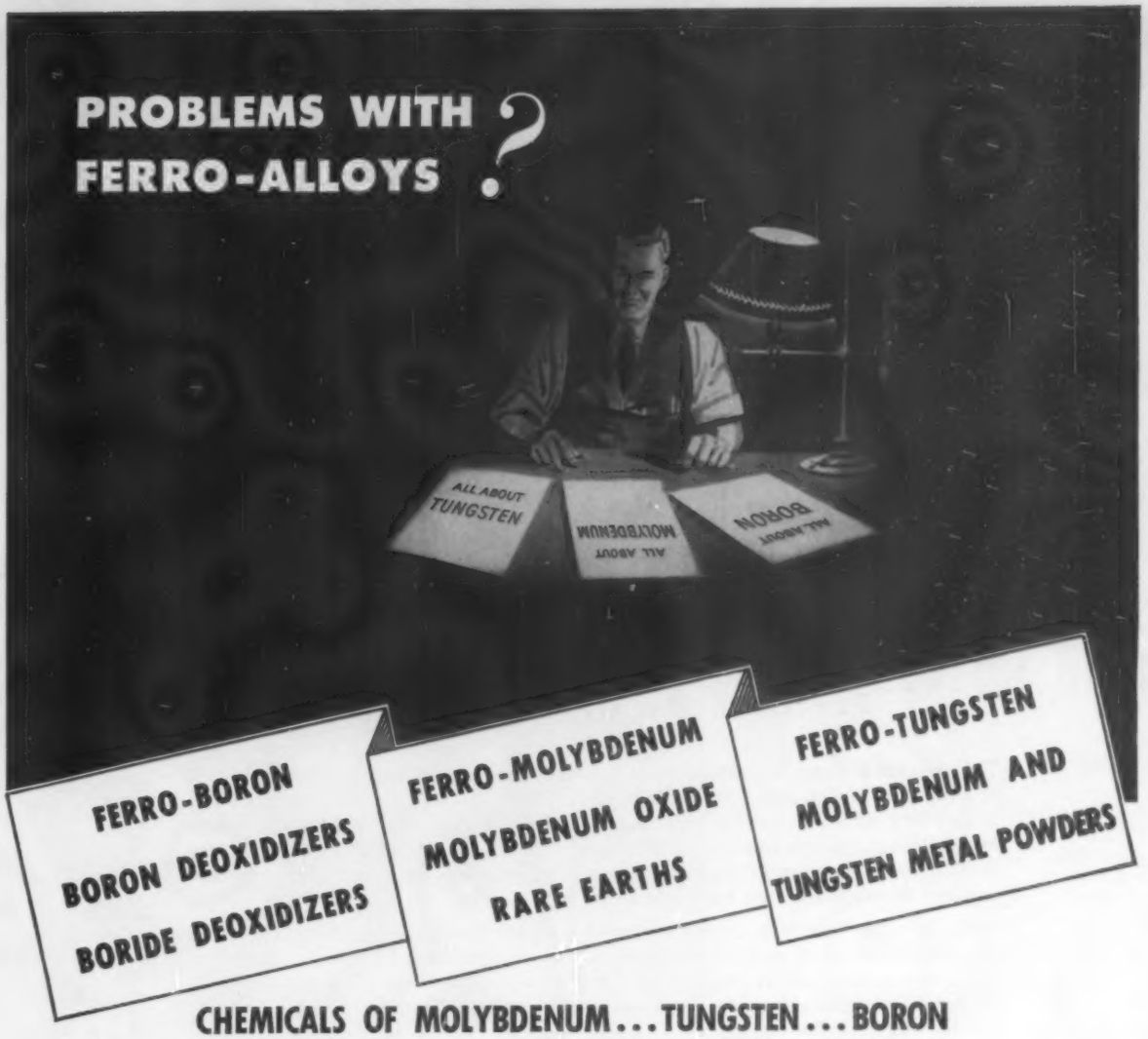

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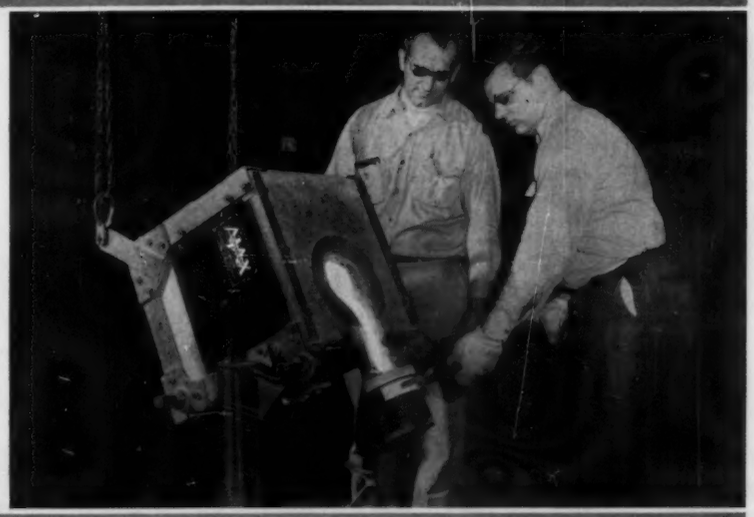
CIRCLE NO. 141, PAGE 13-14

how Ajax induction melting meets investment casting requirements



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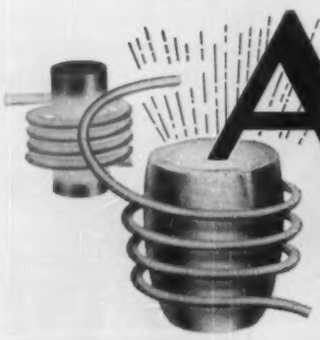
Associated Companies: Ajax Electric Company—Ajax Electric Furnace Co.—Ajax Engineering Corp.



AJAX NORTHRUP SINCE 1916

INDUCTION HEATING-MELTING

SEE US AT THE METAL SHOW—BOOTH 1609 (in the Arcade)

CIRCLE NO. 142, PAGE 13-14

Eastern Malleable Iron Company, Naugatuck, Conn.

Secretary: Myron H. Gould, Aluminum Company of America, Bridgeport, Conn.

Treasurer: Frederick C. Irving, Jr., Aluminum Company of America, Bridgeport, Conn.

Directors: Donald F. Sawtelle, Malleable Iron Fittings Company, Branford, Conn.; Stephen J. LeRoy, Connecticut Coke Company, New Haven, Conn.; James E. Chafey, Chase Brass & Copper Company, Waterbury, Conn.

Hugh Pope, 112 Bridge St., Naugatuck, Conn. is the membership chairman.

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Chairman: John Nabrezny, Michigan Malleable Iron Co., Detroit.

Vice-Chairman: Clair Crawford, Theim Products Co., Detroit.

Secretary: R. Grant Whitehead, Claude B. Schneible Co., Detroit.

Treasurer: Eugene J. Passman, Frederic B. Stevens, Inc., Detroit.

Directors: Everett G. Gentry, Penola Oil Co.; Harold C. Grant, Ford Motor Co.; Cecil N. King, Chrysler Corp.; Theodore Schroeder, Pontiac Motor Div., General Motors Corp.

Membership chairman is Vaughn C. Reid, 1161 Harper Ave., Detroit.

Mid-South

Chairman: Charles D. Gray, Layne & Bowler, Inc., Memphis, Tenn.

Vice-Chairman: E. J. Johnson, International Harvester Co., Memphis, Tenn.

Secretary-Treasurer: J. R. Karlovic, Standard Brake Shoe & Foundry Co., Memphis, Tenn.

Directors: Dale Thompson, Cordova Machine & Foundry Co., Cordova, Tenn.; Al Tragarz, International Harvester Co., Memphis, Tenn.

Thomas W. Bant, 3784 Faxon Ave., Memphis, Tenn. is the membership chairman.

Eastern Canada

Chairman: Morris G. McQuiggan, LaSalle Coke Co., Montreal, Que.

Vice-Chairman: P. Von Colditz, Canadian Car & Foundry Co., Ltd., Montreal, Que.

Secretary: Leopold Myrand, Montreal Foundry Ltd., Montreal, Que.

Treasurer: Morris Pascal, Crane Ltd., Montreal, Que.

Directors: F. Allon, Shawinigan Chemical Ltd., Shawinigan Falls, Que.; M. P. Fisher, Enterprise Foundry Co., Ltd., Sackville, New Brunsdick; L. Gadoury, Crane Ltd., Mon-

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Alabama—Foundry Service Co.
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California—Independent Foundry Supply Co.
Los Angeles 22

California—Industrial & Foundry Supply Co., Inc. of California
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Chicago 28

Illinois—Fore Foundry Supply & Service Co.
Chicago 10

Illinois—Steelman Sales Company
Chicago 4

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Chicago 3

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Moline

Massachusetts—Klein-Farris Co., Inc.
Boston 11

Michigan—Foundries Materials Company
Coldwater (Main Office), and Detroit

Minnesota—Smith-Sharpe Co.
Minneapolis

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Missouri—Mr. Walter A. Zeis
Webster Groves

New Jersey—Asbury Graphite Mills, Inc.
Asbury

New York—Combined Supply & Equipment Co.
Buffalo 7

New York—G. W. Bryant Core Sands, Inc.
McConnellsville

Ohio—Stoller Chemical Co.
Arkon 20

Oregon—La Grand Industrial Supply Co.
Portland 1

Pennsylvania—Pennsylvania Foundry Supply & Sand Co.
Philadelphia 24

Tennessee—Robbins & Bohr
Chattanooga

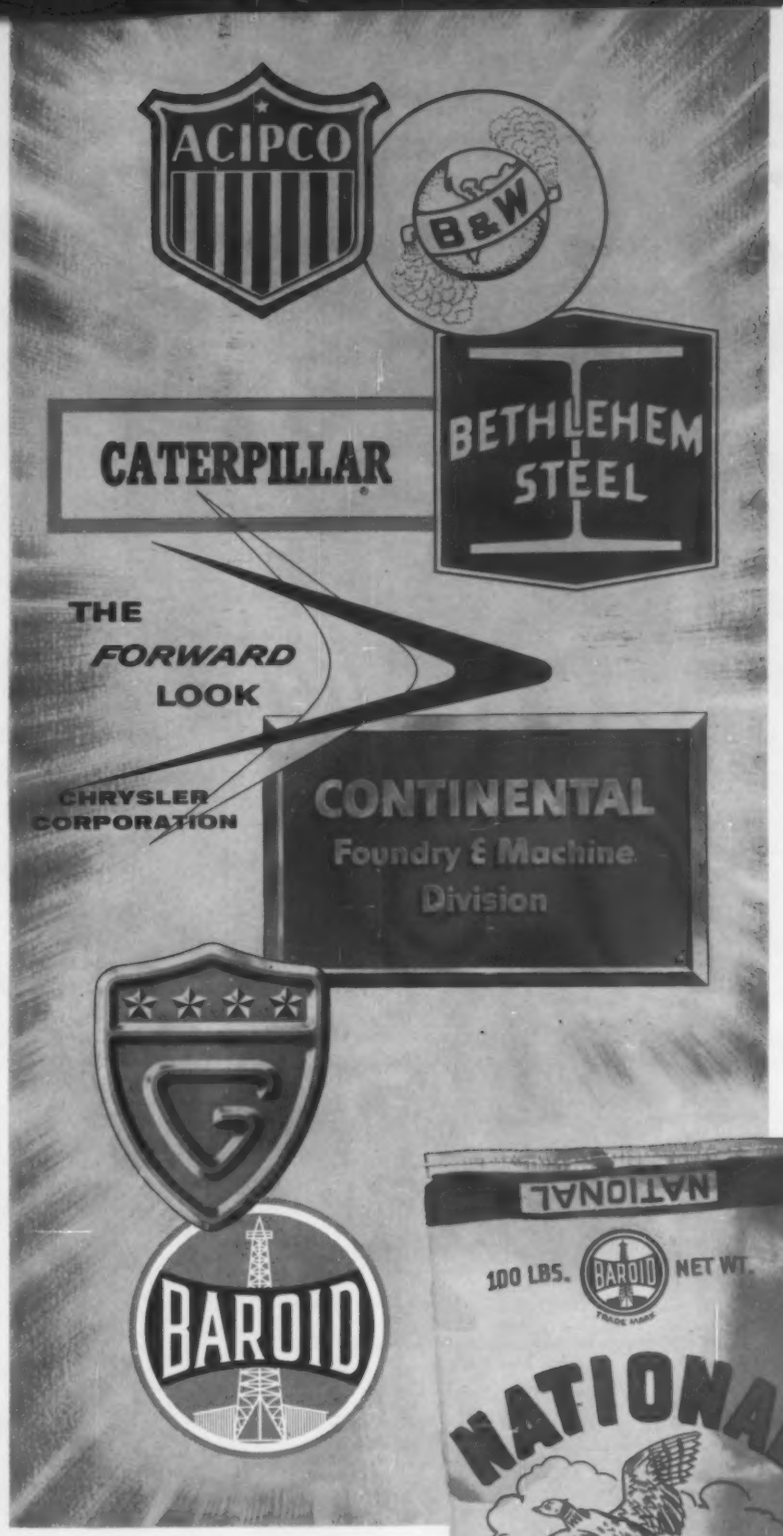
Washington—Carl F. Miller & Co., Inc.
Seattle 4

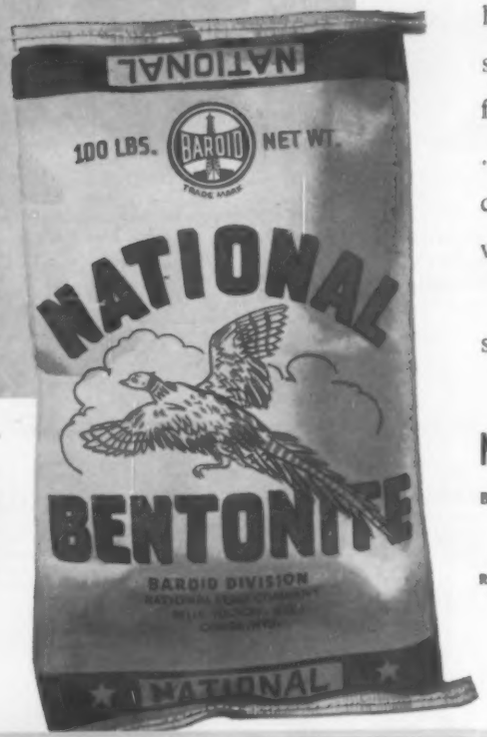
Washington—Pearson & Smith Distributing Div., Spokane Pres-To-Log Co.
Spokane

Wisconsin—Interstate Supply & Equipment Co.
Milwaukee 4

Canada—Canadian Foundry Supplies & Equipment, Ltd.
Montreal, Quebec (Main Office) and Toronto, Ont.

CIRCLE NO. 143, PAGE 13-14





Baroid

NATIONAL BENTONITE .....their source for better bond

Big foundries . . . big users depend on National Bentonite to bond better molds, minimize sand problems and rejects.

They know they can rely on National Bentonite for uniform high quality . . . hot strength to resist erosion, washing and cutting . . . fewer blows, pin holes or rejects . . . less gas and steam to vent . . . castings that peel clean, shakeout with fine finish.

You can test National Bentonite's superior qualities. Write for sample.

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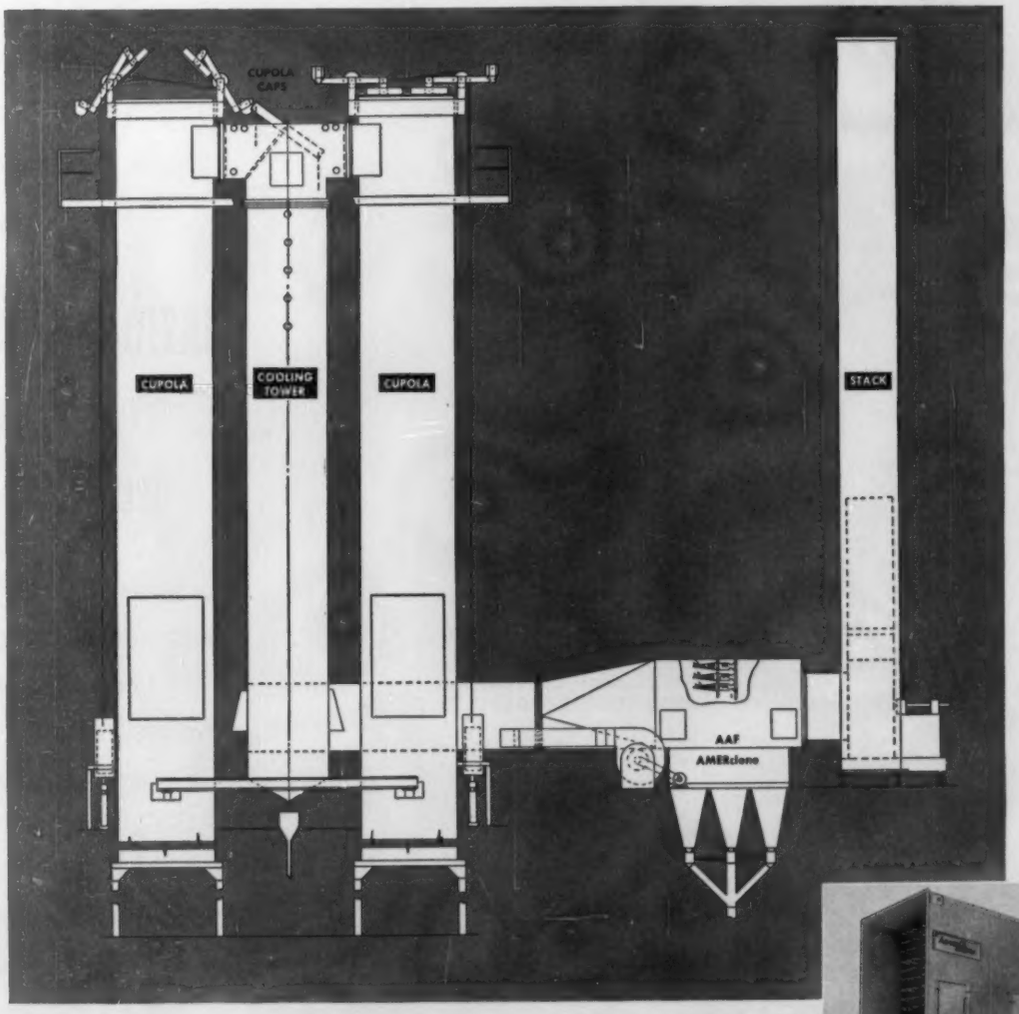
Bentonite Sales Office:

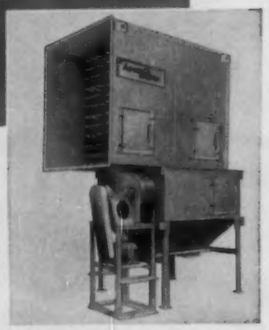
RAILWAY EXCHANGE BLDG. CHICAGO 4, ILLINOIS

5623

AAF AMERclone .... for CUPOLA Dust Control

CONCEIVED 1952 INTRODUCED 1955 PROVED 1956



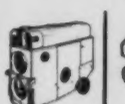


Since its introduction just one year ago, AAF's AMERclone dust collection system has become an accepted solution for control of cupola dust. It *gets* the particles that cinder catchers *miss*—the *small* particles that create *big problems.*

One AMERclone system handles two cupolas alternately . . . permits full-time use of equipment. Dust and cinders are collected dry, which simplifies disposal and prevents corrosion of collection system.

For complete information, call your nearest AAF representative or write direct for AMERclone Cupola Bulletin 292.

American Air Filter
COMPANY, INC.
104 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.


Herman Nelson Portable Heaters

Illinois Heating Specialties

BETTER AIR IS OUR BUSINESS

AAF Electric Furnace Hoods

AAF Type K Exhauster

CIRCLE NO. 144, PAGE 13-14

Iowa Couple Celebrates 50 Years In Industry

Sharing has been a life-long experience for the August Van Lantschoots of Fairfield, Iowa. Both were born November 28, 1889 in Belgium and both have more than 50 years in the foundry industry. They are now active in Fairfield Aluminum Castings Co. of Fairfield.

Mr. Van Lantschoot came to the United States and Fairfield in 1906

Mr. & Mrs. Van Lantschoot

where he was employed by the Iowa Malleable Iron Co. On his arrival he neither read nor spoke English and his first job was unloading a railroad coal car.

Mrs. Van Lantschoot started her career in the foundry business at South Bend, Ind., with the Meyer Gray Iron Foundry Co. She was there six years prior to her marriage and then was also employed by Iowa Malleable. For 34 years she was active with Iowa Malleable and for the past 10 years has been treasurer and office manager of Fairfield Aluminum Castings Co.

At 20, Mr. Van Lantschoot became a shipping clerk for Iowa Malleable, then supervised the annealing and melting departments and became a cost accountant. In 1919, through the efforts of the general manager of the company, Mr. Van Lantschoot was able to study at the Malleable Iron Research Institute, then at Albany, N. Y., and at Rensselaer Polytechnic Institute, Troy, N. Y.

Following his studies he became metallurgist and assistant superintendent at Iowa Malleable and general manager in 1925. He resigned in 1945 to start Fairfield Aluminum Castings Co.

Both of the Van Lantschoots were presented with gold service pins for 50 continuous years in the foundry industry at the recent AFS Castings Congress & Show.

foundry trade news

Birdsboro Steel Foundry and Machine Co. . . has merged with Universal Major Elec. Appliances, Inc., Baltimore, Md. Purpose of the merger was to acquire the operations of Mirawal Corp., manufacturing operation of Universal Major. Birdsboro company name and officers remain unchanged.

Morris P. Kirk & Son, Inc. . . Los Angeles subsidiary of National Lead Co. has formed a new company, Pioneer Aluminum, Inc. to consolidate activities of Pioneer Aluminum Supply Co., Pioneer Tool Eng. Co., Consolidated Casting Co., and Republic Smelting and Refining Co.

American Smelting and Refining Co. . . has started production of phosphor-copper at its San Francisco plant. This is the first production of phosphor-copper in the West.

National Carbon Co. . . will open a laboratory at Parma, Ohio, for research into chemical and solid state physics on September 18. Dr. R. G. Breckenridge will head the new multi-million dollar facility.

Thor Power Tool Co. . . has started construction of a building to house its Indianapolis branch operations. New building will be the firm's 25th sales and service center. Indianapolis address will be 1489 N. Harding St.

A. P. Green Fire Brick Co. . . has reorganized and has acquired Pyro Refractories Co., Oak Hill, Ohio; Durex Refractories Co., Jackson, Ohio; and Portsmouth Clay Refractories Co., South Webster, Ohio.

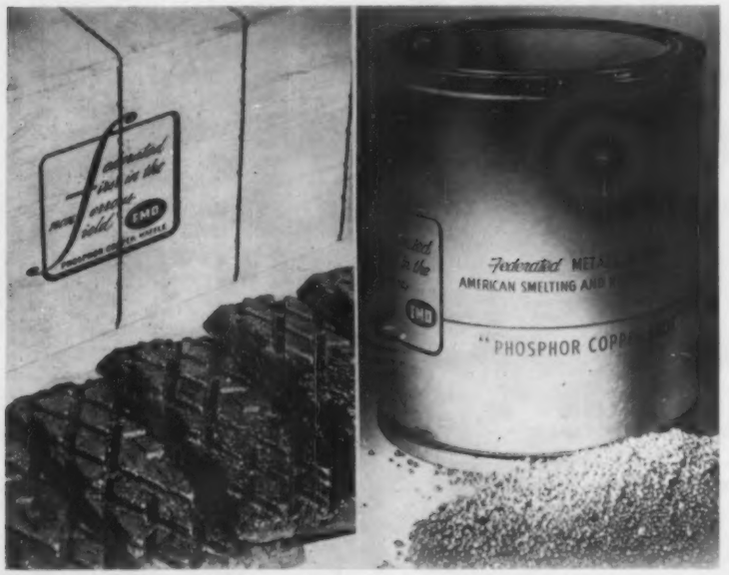
Baird Associates, Inc., and Atomic Instrument Co. . . have merged to provide enlarged engineering staff and supplement sales and service. Companies produce equipment for spectrochemical analysis and for control instrumentation.

Baker-Raulang Co. . . has established a Chicago factory branch office at 5627 S. Harlem Ave. to provide sales and service facilities for its line of materials handling trucks.

Engineer and Foundryman . . the official journal of the Steel and Engineering Industries Federation of South Africa has completed its 20th successful year of service to its readers.

American Smelting and Refining Co. . . has published a booklet that reviews the world-wide operations of Asarco through 4-color photos.

International Molding Machine Co. . . has appointed M. A. Bell Co., St. Louis, as agent for the complete International line of molding machines.



Phosphor-copper has now gone into production on the West Coast.

Cut foundry operating costs . . .

Transite Core Plates are strong and durable . . . resist warpage, impact and abuse, provide long service life.

with Transite Core Plates and Slip Jackets

"Johns-Manville Transite* Core Plates help assure maximum production in minimum time"—that's the experience of foundrymen who have used them for years. Made of asbestos and cement, they are light in weight, yet strong and durable. Being non-metallic, they resist corrosion, maintain their smooth surface and can be easily cleaned.

Transite Slip Jackets are a companion product with similar advantages. They do not burn, retain their original shape despite runouts. Slip jackets are furnished in both white and black types. The latter is widely used as a protective liner for metallic slip jackets.

FREE . . . New Folder gives complete details on Transite Core Plates and Slip Jackets—as well as Transite Pallite products for dielectric furnaces. For your copy of folder PP-31A, write Johns-Manville, Box 60, New York 16; in Canada, 565 Lakeshore Road East, Port Credit, Ontario.

Transite Slip Jackets cost less than other types . . . last longer, too. Result—important savings for foundries.

*Reg. U. S. Pat. Off.

Johns-Manville TRANSITE CORE PLATES AND SLIP JACKETS

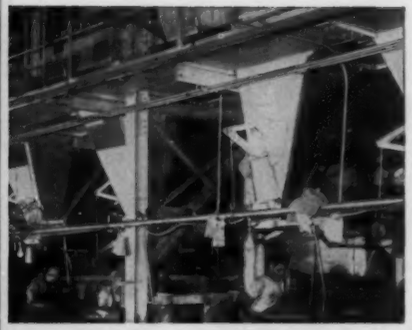
CIRCLE NO. 145, PAGE 13-14

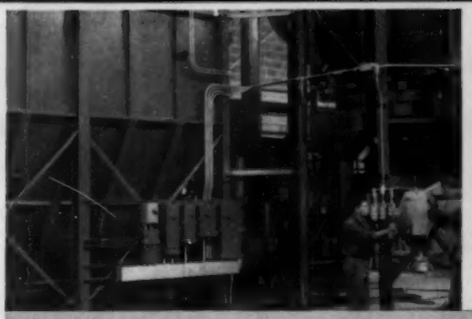
A partial list of Knight clients

Acindar
Buenos Aires, Arg.
Acinfer
Villa Constitucion, Arg.
American Radiator & Standard Sanitary Corp.
Baltimore and Louisville
Appleton Electric Company
South Milwaukee, Wis.
B.I.F. Industries, Inc.
Providence, R. I.
Buckeye Steel Foundry Co.
Columbus, O.
Canadian Car and Foundry Company, Ltd.
Montreal, Quebec
Chrysler Corp.
New Orleans, La.
James B. Clow & Sons Co.
Birmingham, Ala.
Combustion Engineering Inc.
Chattanooga, Tenn.
Crane Company
Chicago, Ill.
Dalton Foundries, Inc.
Warsaw, Indiana
Electric Steel Foundry Company
Portland, Ore.
Erie Malleable Iron Company
Erie, Pa.
Fahralloy Limited
Orillia, Ont.
Fairbanks, Morse & Company
Kansas City, Kan.
Ft. Pitt Steel Castings Division
McKeesport, Pa.
Hammond Brass Works
Hammond, Ind.
Haynes Stellite Company
Kokomo, Ind.
Macfarlane
Sagua la Grande, Cuba
Moline Malleable Iron Company
St. Charles, Ill.
National Roll & Steel Foundry
Avonmore, Pa.
Pittsburg Steel Foundry Corporation
Glassport, Pa.
Sulzer Bros. Ltd.
Winterthur, Switzerland
Unitcast Corporation, Ltd.
Sherbrooke, Quebec
Universal Castings Corporation
Chicago, Ill.
Wagner Malleable Iron Company
Decatur, Ill.
Woodruff & Edwards, Inc.
Elgin, Ill.
Worthington Corporation
Harrison, N. J.

HUNDREDS OF FOUNDRIES CALL ON EXPERIENCED KNIGHT ENGINEERS FOR

PRACTICAL, RELIABLE ASSISTANCE...





...ON VIRTUALLY ALL FOUNDRY PROBLEMS!

The key men in Lester B. Knight & Associates, Inc. have from 10 to 30 years successful experience in some phase of foundry management, production, engineering or equipment. The coordination of each man's specialized experience has enabled the Knight organization to complete hundreds of successful assignments in every type of foundry—grey iron, steel, malleable, brass and bronze, magnesium, and aluminum. These foundries are producing castings from a few ounces to 50 tons, and from 1 to more than 1,500 tons of castings per day. Green sand, dry sand, cement, plaster, "shell" molds, permanent mold, centrifugal, die casting and investment casting operations all have been served by Knight.

Working closely with clients' staffs, Knight Engineers have assisted its clients to audit operations, define management functions, establish organization, modernize methods and facilities, and design complete new plants. They have successfully applied automation in varying degrees to a number of different types of foundries, and have assisted management to establish more economical procedures for the control of operations and costs.

Your operation can benefit by this comprehensive experience. A letter will bring a call from a Knight representative at your convenience.

Write for Knight Bulletin No. 101, "Professional Foundry Engineering."

EVIDENCE OF EXPERIENCE

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CIRCLE NO. 146, PAGE 13-14

Ways Suggested to Cut Thermal Spalling

At temperatures from normal to 1100 F, silicon carbide refractories are the most susceptible to thermal spalling. Extreme care is recommended in heating and cooling in the very low ranges between 200 F to 600 F.

In this range, cristobalite, the form in which a small amount of silica is most likely to be present in silicon carbide, undergoes a reversible transformation at approximately 405 F from one form to another accompanied by a substantial change in volume. Therefore, if silicon carbide refractories are carried through this critical temperature too rapidly, the tensile stresses induced may result in cracking and spalling. From room temperature to 500 F, a suggested rate of heating is 100 F or less per hour.

In the range of 500 F to 1100 F, a heating or cooling rate of not greater than 300 F has been used safely in smaller sizes of furnaces. In heating up past 1100 F to soaking temperatures and cooling down again to 1100 F, a slightly higher rate, about 400 F per hour may be employed.

Factors to consider in choosing a thermal shock-resistant refractory include the magnitude of thermal shock, the furnace design, operating conditions and the physical properties of the refractory. In general, the tensile strength, thermal conductivity, modulus of elasticity and coefficient of thermal expansion are the main characteristics that help determine the degree to which a refractory will resist thermal shock.

With the application of the proper variety and design of silicon carbide refractories and observance of precautions, the harmful effects of thermal shock can be overcome successfully.

More information on any of the products and services advertised as listed in MODERN CASTINGS can be yours without cost or obligation. Just circle the item numbers on the Reader Service Cards provided on pages 13-14.

AFS Northwest Regional Set for Seattle

Seattle will be the site for the 1956 Northwest Regional Foundry Conference sponsored by the Washington, Oregon, and British Columbia industrial chapters and the Oregon State College Student Chapter of the American Foundry-

Fred R. Young

men's Society. This year's event has been scheduled for October 19-20 at the Benjamin Franklin Hotel, Seattle.

All technical meetings, lunches and the banquet and dance will take place at the hotel. Two events not scheduled for the hotel are the ladies luncheon, which is to be held at the Seattle Tennis Club, and a field trip through the Washington Iron Works in Seattle.

Eight technical sessions have been scheduled for the two-day program. Topics to be presented include: Foundry Sand Problems, Gating and Risering of Cast Iron and Steel Castings, Core Oil and Core Making, Welding of Cast Metals, Light Metals Melting Practices, Brass Foundry Practices, Steel Foundry Practices, plus a motion picture on aircraft testing.

Fred R. Young, E. A. Wilcox Co., is general chairman of the regional and James N. Wessel, Puget Sound Naval Shipyard is the program chairman.

Now Where Was That?

■ You will have no trouble locating articles in back issues if you write for the index to 1955 issues of MODERN CASTINGS.

Now, more than ever, you can depend on

HANNA

as your best source for

PIG IRON

- *Our merchant capacity is bigger than ever*
- *Our plant is better than ever*
- *Our product range is greater than ever*

The
HANNA 38-POUND PIG

The foundryman's favorite standard pig. Available in all grades, silvery and HannaTite. A good example of the quality that has made Hanna "the best known name in iron."

The New
EXCLUSIVE HANNATEN INGOT

For 10-lb.-pig users, this new ingot means no free-carbon pockets, finer grain structure, more even melting. Available in all grades, silvery and HannaTite—an extra-close-grain iron.

THE HANNA FURNACE CORPORATION
Buffalo • Detroit • New York • Philadelphia
Merchant Pig Iron Division of
NATIONAL STEEL CORPORATION

CIRCLE NO. 147, PAGE 13-14

USING TOO MUCH COKE?

Why not talk this over with one of our metallurgists with a view to taking advantage of the superior quality of Semet-Solvay Foundry Coke in reducing your melting costs.

SEMET-SOLVAY DIVISION
ALLIED CHEMICAL & DYE CORPORATION
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Buffalo • Cincinnati — Cleveland • Detroit
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Western Distributor: WILSON & GEO. MEYER & CO., San Francisco

For Better Melting

CIRCLE NO. 148, PAGE 13-14

STANDARD
does it again!
The KOOLHEAD 90°

The 90° bend under the head simplifies your operation and places the chill where it belongs. The "Koolhead 90°" will perform two duties: (1) a chill and (2) holding the sand on the surface of the mold. We feature clean, bright finished Horse Nails and can furnish the new bent head in any of the various "Koolhead" types.

Write for samples and prices.

CHILL KOOLHEAD NAILS

STANDARD HORSE NAIL CORP
Since 1872
NEW BRIGHTON, PA

CIRCLE NO. 149, PAGE 13-14

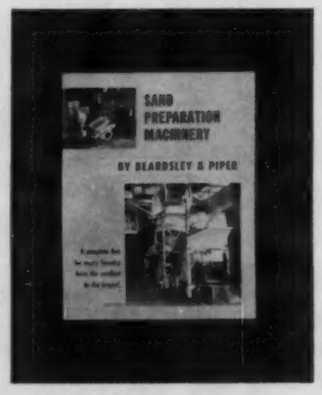
for the asking

Green core coatings, Pyrokoat-G and Pyrokoat-S washes discussed in brochure. Former is for gray iron and non-ferrous castings, latter for coating steel and malleable. Also discussed is Super-Koat, a wash for green or dry sand cores. *Delta Oil Products Co.*
CIRCLE NO. 61, PAGE 13-14

Non-destructive testing is described in 12-page booklet "Seeing Isn't Always Believing." Includes inspection of magnetic materials, non-magnetic solids, electrified particles, filtered particles and other processes. *Magnaflux Corp.*
CIRCLE NO. 62, PAGE 13-14

"Moly Iron Castings" a series with technical information and case histories on molybdenum in alloying gray iron castings. First two bulletins now available. *Climax Molybdenum Co.*
CIRCLE NO. 63, PAGE 13-14

Sand preparation machinery designed for any size foundry published in well illustrated 23-page bulletin,



No. 1230. Some pictures show equipment in operations. *Beardsley & Piper Div., Pettibone Mulliken Corp.*
CIRCLE NO. 64, PAGE 13-14

Condensed catalog of available foundry equipment, No. 564 includes four picture pages of products, remaining 47 pages on product description and application. *Syntron Co.*
CIRCLE NO. 65, PAGE 13-14

Refractory castable placement method, "Extrud-a-Flow" explained in 24

page book. Contains charts, graphs, illustrations and tables. Materials are extruded by pressure from sealed mixing chamber. *Mexico Refractories Company.*
CIRCLE NO. 66, PAGE 13-14

Melting furnace auxiliary items shown in eight-page, 2-color catalog, No. 601. Products illustrated, plus charts covering dimensions, burner and blower ratings and cross section diagrams. *Lindberg Fisher Div., Lindberg Engineering Co.*
CIRCLE NO. 67, PAGE 13-14

Snotter problems in casting, a reprint from MODERN CASTINGS. Well illustrated with general discussion. *American Colloid Co.*
CIRCLE NO. 68, PAGE 13-14

General information on origin, products manufactured, plants, mines, research and development covered in illustrated booklet. *Vanadium Corp.*
CIRCLE NO. 69, PAGE 13-14

Dust collection, its advantages and size are discussed in booklet No. 56, illustrated with cartoons, cutaways and product photos. The book describes

dust damage, general information and uses and reductions in operational expenses. *Torit Manufacturing Co.*

CIRCLE NO. 70, PAGE 13-14

Corrugated box stacking and loading discussed in 16-page booklet. Nine basic rules discussed as well as effec-

tive methods of estimating storage space, distributing load weights, handling, identification, etc. *Hinde & Dauch.*

CIRCLE NO. 71, PAGE 13-14

Core binder, Foundrez 7991, described in three-page bulletin. Said to combine desirable green working properties of core oils and casting properties of water-soluble phenolic resins. *Reichhold Chemicals, Inc.*

CIRCLE NO. 72, PAGE 13-14

Metal abrasives, five types described in colored folder, all abrasives packed in 50-lb double burlap bags. *Pittsburgh Crushed Steel Co.*

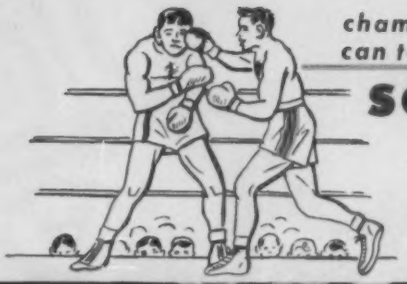
CIRCLE NO. 73, PAGE 13-14

Cutting and grinding with wet fluids, Adv. 2095. 14-page booklet describes properties of wax as they

assist cutting functions of metals, lowering cutting temperatures and increasing tool life. Also a comparative machinability table. *S. C. Johnson & Son, Inc.*

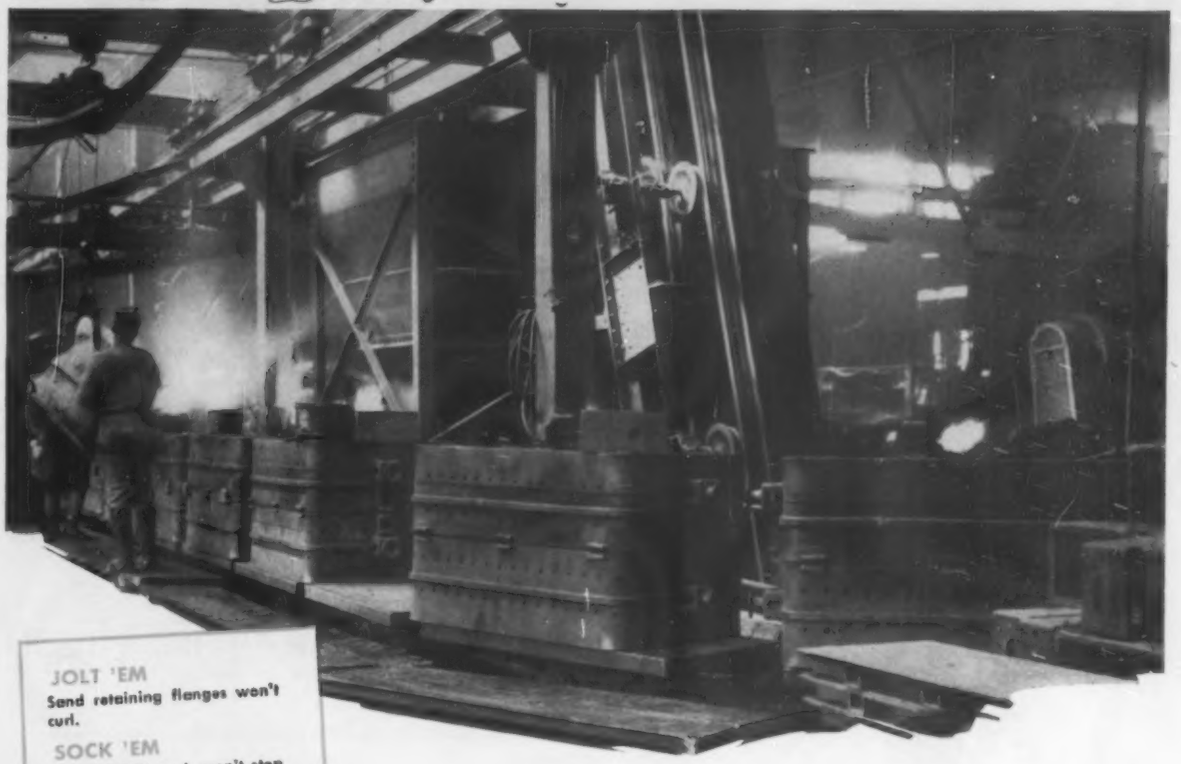
CIRCLE NO. 74, PAGE 13-14

Bucket elevator, screw conveyor and vibrator combination shown in brochure P-30. Units designed to handle



champions can take it

SO CAN Sterling FLASKS



JOLT 'EM
Sand retaining flanges won't curl.

SOCK 'EM
Even 60,000 p.s.i. won't stop a Sterling.

PILE 'EM ON
You can stack-mold to a height of 10 sections, or more.

WORK 'EM OVER
Pour as often as you like.

"SAND BAG" 'EM
No soft spots under sand flange.

SQUEEZE 'EM
Sterlings love it!

● You can keep foundry production rolling . . . pour 4, 5, 6 times a day, or more . . . and your Sterling Flasks will still retain their rigidity and accuracy. What's more, they will give you this performance day after day, for YEARS. *Custom-built,* all-welded into a single rigid piece . . . Sterling Rolled Steel Channel Flasks have the strength and ruggedness to resist every kind of impact, stress or torsion. They give you faster molding, easier shake-out, more profitable operation from start to finish.

See your Sterling representative for complete information, or write directly to the factory.

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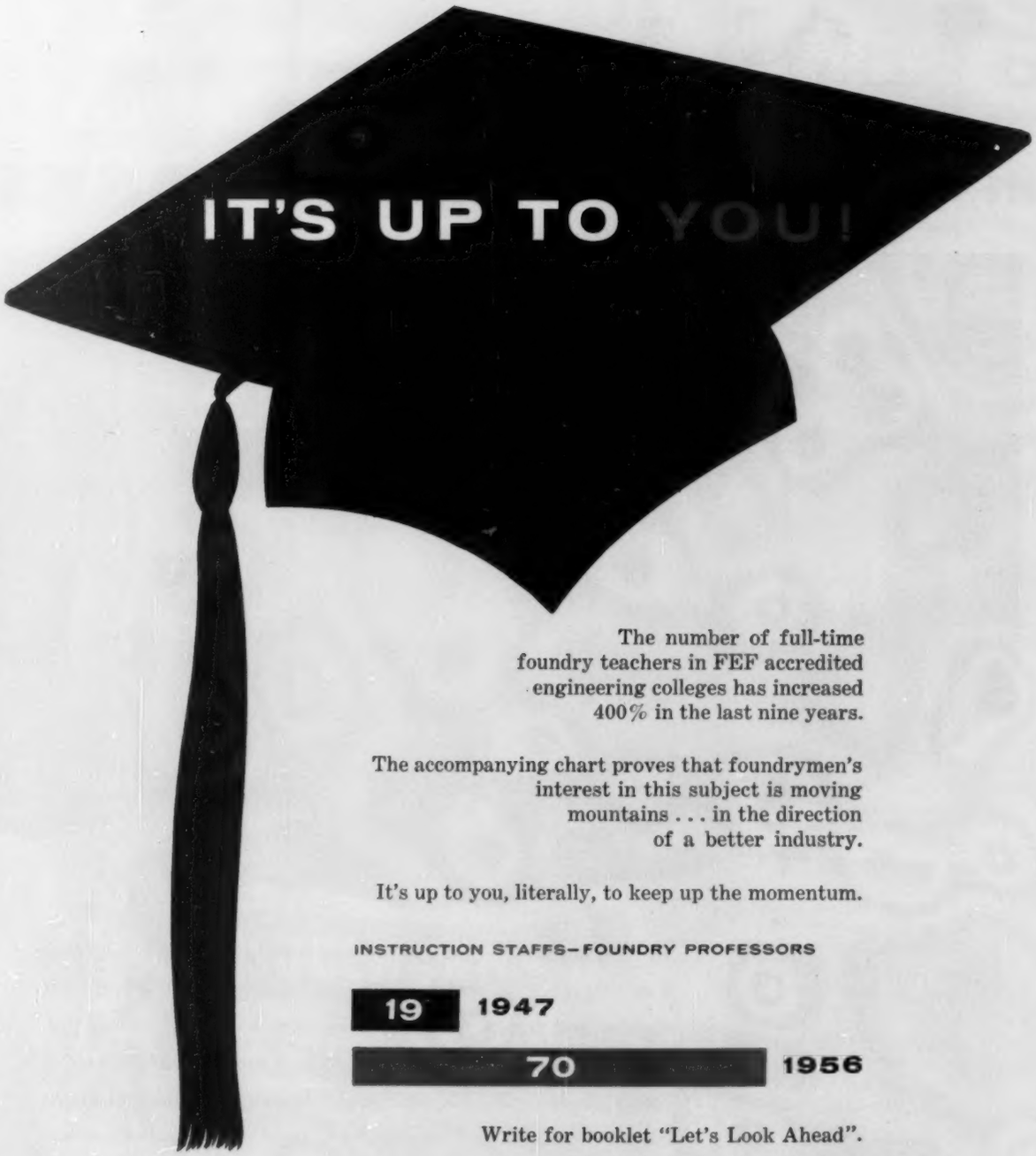
CIRCLE NO. 150, PAGE 13-14



The number of full-time foundry teachers in FEF accredited engineering colleges has increased 400% in the last nine years.

The accompanying chart proves that foundrymen's interest in this subject is moving mountains . . . in the direction of a better industry.

It's up to you, literally, to keep up the momentum.

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Space Contributed by **modern castings** as another service to the metal castings industry.

CIRCLE NO. 151, PAGE 13-14

abrasive dusty materials such as submerged arc welding flux, sand, chemicals, grains and plastic. *Prab Conveyors, Inc.*

CIRCLE NO. 75, PAGE 13-14

Anti-bridging discs made in black iron, galvanized, or stainless steel are built and shipped in sections and erected by bolting. Fire-proof and vermin-proof walls with flush joining. *The Day Co.*

CIRCLE NO. 76, PAGE 13-14

Nailed wooden and lock corner box specifications for domestic and export shipments are contained in bulletin I-1A. Supersedes tentative specifications issued previously by *National Wooden Box Association.*

CIRCLE NO. 77, PAGE 13-14

Ductile iron as a material for petroleum pipe is discussed in 4-page paper. Includes pictures and reference table. *The International Nickel Co., Inc.*

CIRCLE NO. 78, PAGE 13-14

Base blocks and furnace covers discussed in No. 7 of a series. Includes general information, selection and use and functions. *Crucible Manufacturers' Assn.*

CIRCLE NO. 79, PAGE 13-14

High refractory core and mold coatings listed in Bulletin 56-1. Six pages of pastes, powders, core oils and other products. *Thiem Products, Inc.*

CIRCLE NO. 80, PAGE 13-14

Power steering designed for "Towmotor" fork lift trucks 6000 lb and

over described in Lot No. SP 13. Only 3½ turns needed to turn full radius. *Towmotor Corp.*

CIRCLE NO. 81, PAGE 13-14

Fluxes for degassing and cleansing of red brass, tin bronze and copper nickel alloys, described in four pages

with description, instructions, packing and case history. Leaflet No. A2. *Foundry Services, Inc.*

CIRCLE NO. 82, PAGE 13-14

Air-driven pump is designed for pumping molten metals or salts. Motor is self-cooling, submerged parts are steel or stainless steel. Top flow capacity is 36,000 pounds per hour at 90 psi air. Bulletin 800 tells more. *Ajax Electric Co.*

CIRCLE NO. 83, PAGE 13-14

Wet-type dust collector called the Ventrijet is illustrated and described in 8-page Bulletin 920. Fifteen photos and drawings show the unique venturi action, with dimensions, weights, and capacities given in three tables. *Pangborn Corp.*

CIRCLE NO. 84, PAGE 13-14

Ladle transfer car at Roanoke Electric Steel Corporation's plant is letting them pour ingot molds faster —and at lower cost! One-page folder tells how. *Whiting Corp.*

CIRCLE NO. 85, PAGE 13-14

Aluminum alloy brochure giving mechanical properties, composition and heat treatments covered in 15 pages. Easy to read reference tables. *Apex Smelting Company.*

CIRCLE NO. 86, PAGE 13-14

Turbo-compressors for foundry cupolas discussed in bulletin No. 112B. Manual or automatic control. Illustrations, performance chart and cupola air requirement chart. *The Spencer Turbine Co.*

CIRCLE NO. 87, PAGE 13-14

Condensed industrial catalog on hose, fittings, socketless kits and self-sealing couplings, Cat. 174. Includes instructions on ordering, installation planning and assembling. *Aeroquip Corp.*

CIRCLE NO. 88, PAGE 13-14

Sieves, sieve shakers, sample splitters described in 4-page bulletin. Lists 47 sieve sizes available. Both motorized and hand operated models. *Soiltest, Inc.*

CIRCLE NO. 89, PAGE 13-14

Coreless line frequency induction furnaces and their recent European developments presented at AFS Castings Congress. Bulletin R50. *Ajax Engineering Corp.*

CIRCLE NO. 90, PAGE 13-14

Electrical indicating instruments, includes complete line in addition to test equipment. Manual 17, 87 pages, has wiring diagrams, dimensional drawings and photographs printed in

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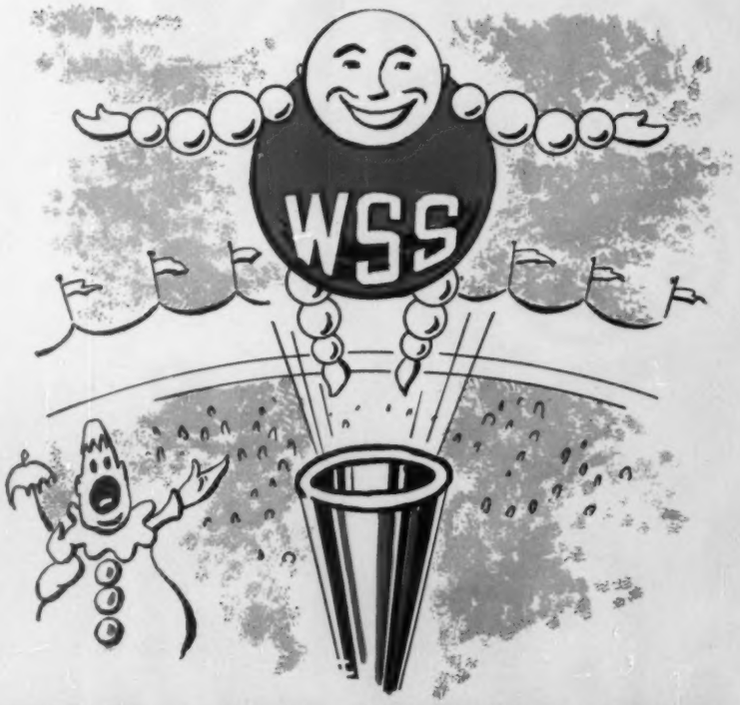
CIRCLE NO. 152, PAGE 13-14



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CIRCLE NO. 153, PAGE 13-14

two colors on glossy paper. *Simpson Electric Co.*

CIRCLE NO. 91, PAGE 13-14

Overhead crane catalog features a whole line of underhung units for a broad range of applications. Types include push-type flexible bridge and standard, hand geared, and various modifications of motor-driven types. Enough capacity for foundry uses, says Bulletin U-200-1. *Chicago Tramrail Corp.*

CIRCLE NO. 92, PAGE 13-14

Test bar information on non-ferrous alloys contained in four-page folder includes illustrations and suggested standard procedures. *The George Sall Metals Co.*

CIRCLE NO. 93, PAGE 13-14

Nickel-aluminum bronze gives high tensile properties; resistance to corrosion, cavitation and erosion; and weight savings to 20%. "What's New in Aluminum Bronze?" tells about it in 8 pages of tables, charts, and photos. *International Nickel Co.*

CIRCLE NO. 94, PAGE 13-14

Dextrines have their uses in the foundry, reports an interesting progress bulletin. Their industrial functions include binders, coatings, fillers, laminants, sealers, etc. *Morningstar, Nicol, Inc.*

CIRCLE NO. 95, PAGE 13-14

Steel shop equipment described in five pages. Includes benches, tool cabinets, shelving, chairs and desks. *Standard Pressed Steel Co.*

CIRCLE NO. 96, PAGE 13-14

Flexible shafting selection information contained in 12-page engineering bulletin No. 570. Sizes range from 1/8 to 1-5/8 in. *Stow Manufacturing Co.*

CIRCLE NO. 97, PAGE 13-14

General catalog on scientific laboratory equipment, 16 pages with pictures, specifications and prices. *Schaar & Company.*

CIRCLE NO. 98, PAGE 13-14

Cleaning and polishing aluminum or cast iron core boxes discussed in case history No. 108. Shows previous method and how problem was solved. *Cratex Manufacturing Co.*

CIRCLE NO. 99, PAGE 13-14

Carbide grinding wheels described in bulletin E-149-56. Furnishes wheel sizes, plate specifications and data on machines of 16 manufacturers. *Robertson Mfg. Co.*

CIRCLE NO. 100, PAGE 13-14

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CIRCLE NO. 153, PAGE 13-14

foundry facts

Sand / Technological Principles

Outline of Sand Technology is being condensed in three installments from the Sand Technology Short Course available at 50¢. Components of molding sands were discussed last month in the first article.

Properties of Molding Sands

Control is the first step toward a general improvement and cost reduction program. Quality automatically follows.

9. Permeability was the first property of sand to be tested. It can be considered as a measurement of casting finish as well as ventability. Any rapid and unaccounted for change in properties usually spells trouble and this is especially true for permeability.

Low permeability may be caused by too fine a sand, too high a water content, too tight a ram, or too many inert fines in the mixture. Distribution and shape of grains also affect permeability.

Base permeability is the permeability of packed, dry sand grains containing no clay or other bonding agent. Green permeability is the permeability of a molded mass of sand in its moist or tempered condition.

10. Green Compression Strength, Permeability, Mold Hardness and Density. The 1-to-10 ram test measures the above four important sand properties, which are interrelated to such an extent that they should not be considered separately. By plotting them, a family of curves is obtained which, with some experience, can give an indication of the quality of the sand mixture.

11. Flowability and Deformation. Completely dry sand is 100% flowable and any additive or ingredient of a sand mixture reduces this flow. Low flowability means more energy is necessary to ram. This reduces the number of molds that can be produced per shift, with a simultaneous loss in dollars. The term "flowability" refers to the movement of sand grains when they are subjected to molding forces. No standard method of measuring it has been developed.

Deformation denotes plasticity and can be felt. It is the amount that a sand "gives" or yields before it breaks. Additives control it. Deformation and flowability are interdependent. There is green deformation and hot deformation. Total deformation multiplied by the green compressive strength value gives a figure known as the sand toughness number—a good control figure.

12. Hot Properties. Tests on foundry sands at elevated temperatures enable the foundryman to understand sand behavior under conditions existing in the mold. No standard tests are available as yet, but much development work has been done. Mold-metal interface reactions, degree of metal penetration, and heat transfer have been studied.

13. Dry Properties. To reduce dry strength, western bentonite and fire clay should be decreased—also the pitch and cereal content. Added amounts of southern bentonite are beneficial. If dry strength is too high, cracks and hot tears may result, as well as difficulties at shakeout, and cleaning costs advance.

14. Casting Finish and Grain Distribution. Change in sand grain distribution can quickly ruin a sand system. Grain distribution can be used to note the effect of core sand entering the molding sand system; it should be used as a standard control.

Flowability of sand is highest when it is completely dry.

Casting finish is largely a function of grain fineness and distribution of the molding (conventional practice, shell sand used, regardless of the method of molding, CO_2 process).

15. Shakeout. The best place to look for and at foundry troubles is where the castings are shaken out. Not only can the sand be observed, but sprues, gates, flasks, equipment, etc., tell the story. If there is much sand retained in pockets, excessive hot strength may be indicated.

Are the castings cracked? Is much burn-on visible? Possibly the amount of combustibles should then be appraised.

Do the guide pins show brutal treatment? Look for shifted castings.

Many foundries use a method of processing their sand which results in excessive retained strength. High shakeout

effort means a large amount of hard sand lumps, which, in turn, cause high sand refuse. This increases the amount of new sand that has to be purchased.

Core Sand Technology

■ The base sand for coremaking must be selected with the molding sand analysis in mind. By doing this, the foundryman assures himself of sand uniformity throughout his plant. The major difference between molding and core sand mixtures is the binder. In molding sands the major binders are clay and water. In core sands, they are drying oils, resins, gelatinized starches, and water.

Although it is evident that molds form the external surfaces of a casting, while cores are employed primarily to hollow out the internal members, this important consideration is often overlooked when studying foundry sand mixtures. The external sand shell permits a foundryman to use more volatile binders in his molding media than in his core sand. Steam (converted from the moisture in molding sands during casting) can be expelled through the external sand shell of a mold while it would have to pass through restricted vents were it present in the cores. The same consideration holds for such other potentially volatile ingredients as sea coal, wood flour, and inhibitors.

This volatile matter in molding sands improves casting finish. It is thought that the type of gas, pressure, rate of evolution, and amount formed during founding can be correlated with the "peel" and surface finish of casting. Unfortunately, this gas cannot be tolerated in core sands for fear of casting blows in and through the metal envelope. Cores are purposely made with a minimum of gaseous constituents and, to provide satisfactory cored surfaces, the foundryman normally resorts to core washes and/or finer sands.

Gas and collapsibility are the major problems to be dealt with in core practice. If these two factors can be controlled, coring out castings presents no unusual problems. The source of gas in a core always can be traced to organic binders and/or moisture. Both should be kept at a minimum. Inorganic binders are potentially less gas forming than organic binders, but they remain in the sand mixture at elevated temperatures and inhibit collapsibility.

Components of Core Sands

1. Inorganic Binders. Recent trends towards the use of CO_2 and water glass as a foundry core binder have reawakened interest in the inorganic binders field. Collapsibility is that factor which is mainly responsible for deterring more rapid progress. Other inorganic materials sometimes used are Portland cement, chemical cements, and ethyl silicates. The liquid ethyl silicates are very expensive while cement-bonded molds occupy considerable floor space during curing and are therefore not used.

The effect of the spent salts from inorganic binders which find their way into the molding sand from core breakdown must be considered. Continued use of inorganic core binders undoubtedly will change the pH of the molding sand system with attendant different physical properties of the molding media.

2. Moisture. Water is the least expensive and most effective binder used in foundry sand mixtures. In every case it should be handled with respect and used as sparingly as possible. It is incorporated in core sand mixtures for one or more of the following reasons: a) to impart green (working) strength, per se, b) to activate the adhesive properties of the binder, and c) to chemically react with one or more of the constituents. The moisture in the sand mixture is an important transient additive and must not remain in the core after processing.

The amount of moisture used is a function of the type of solid binder and the surface area of the sand with which it is mixed. In general, small quantities of water (1-3%) tend to increase green bond while large quantities (3-10%) increase the dry or baked bond. This phenomenon is usually attributed to the solubility of the binder.

In general, inorganic binders require appreciably more moisture than organic binders.

3. Organic Binders—Solid. The most commonly used solid organic binders are cereals, clays, resins, and proteins. Cereal binders are universally used in this country to provide core sand mixtures with both green and baked bond. These products are manufactured from gelatinized starch, and their cold-water gelling characteristic provide green bond, while its adhesive formation at high moistures lends baked strength to the mixture. The hygroscopicity of the cereal bond is an important consideration.

We're getting too much darn foreign matter in our sand lately!

Since both the reduction of core gas and increase in collapsibility are major goals of properly made cores, clays are used sparingly in core mixtures. Only where high green strength is desired with a minimum of green core deformation are they included in the mixture. The tendency for the clay to absorb liquid binders requires the addition of extra amounts with attendant more potential gas; the high hot strengths retard collapsibility.

Solid resins are used as the sole binder in some coring processes. A powdered synthetic resin may be melted and coated over the sand grains, in situ. When such coated sands are placed against a hot core box, the resin becomes tacky so that the sand grains adhere to each other. Further oven heating sets the resin. An intimate mixture of about 5-6% resin in a fine sand is employed. This type of bond is used more successfully for external molds than for internal cores since a great deal of gas forms with this great a concentration of organic binder. Precoated resin sands with attendant hollow cores and higher permeability appear more practical.

Urea formaldehyde is sometimes employed in powdered form as a synthetic core binder. Cereal is universally used when this resin is the bonding agent.

Powdered protein dry binders are sometimes found in core work. These materials such as gelatin, casein, and glues do not have the moisture resistance of the synthetic resins.

British Foundrymen Meet in Cardiff

H. J. V. Williams was elected president of the Institute of British Foundrymen at the 53rd annual general meeting held in Cardiff, Wales, in June. Mr. Williams succeeds Dr. A. B. Everest. J. Blakiston was elected senior vice-president and A. E. Peace was named junior vice-president.

H. J. V. Williams

The Institute's Oliver Stubbs medal was awarded to John Steele of the South African branch and its E. J. Fox medal was given to F. W. E. Spies, president of the Netherlands Foundry Association. Dr. E. R. Walter was given the Meritorious Services medal.

Nearly 500 persons attended the conference. Its organization included one general meeting, six technical sessions involving 14 technical papers, and one day of plant visitations.

W. R. Jaeschke of the Whiting Corporation, who attended the conference, reports an increasing interest in hot blast cupolas and some interest in heavy water-cooling with a minimum or no lining in the combustion and melting zones.

"I saw some very fine foundries, small as compared to ours by tonnage but very up-to-date on production equipment and method and with excellent housekeeping," Mr. Iaeschke said.

"The CO_2 process and shell molding were being practiced to varying extents in the foundries visited.

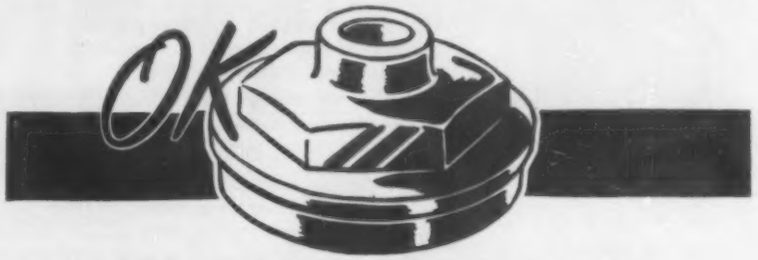
Dr. F. W. E. Spies receives the IBF's E. J. Fox medal from president A. B. Everest.

President's reception at annual banquet: left to right, President H. J. V. Williams, Mrs. Williams, Rt. Hon. The Lord Mayor of Cardiff, The Lady Mayoress of Cardiff, Immediate Past President Everest, Mrs. Everest.

Thread Inserts Cut Costs

Elimination of drilling and tapping threads in manhole frames has been accomplished by using stainless steel thread inserts at E. L. LeBaron Foundry Co., Brockton, Mass. Wire thread inserts, coiled from stainless wire have a diamond shaped cross section, are placed in the mold on sand cores. The cores are removed by sand blasting.

The LeBaron Foundry specializes in gray iron castings for manhole frames, covers and gratings. It reports an improved product with less production time. Formerly the castings, weighing up to 400 lb, had to be sent to the machine shop where drilling templates were made and each hole drilled and tapped. Now the hot metal flowing around the inserts forms a bond just short of fusion. The result is improved product produced in shorter time with lower costs.



BETTER CASTINGS

Denser castings with a finer grain structure, and more easily machineable! Castings with better finish that require less cleaning! THESE are some of the advantages in the close control of pouring temperatures with Marshall Enclosed-Tip Thermocouples.

You want better castings, so use Marshall Thermocouples to measure the temperature of your metals in furnace or ladle. They do the job quickly and accurately. They tell just how hot your metals are. You pour at just the right heat.

Marshall Thermocouples are doing a good job day after day in nonferrous foundries everywhere. They're protected to stand the severe duty. They withstand many immersions.

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1 **Completely rewritten by prominent foundry sand specialists**

2 **Twice as much information as contained in 5th edition**

3 **Includes a glossary**

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5 **259 pages . . . 93 illustrations**

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continued from page 56

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Recipe For a New Alloy

Predesign of a needed set of properties into an alloy can now be accomplished by a technique developed at the Westinghouse Research Laboratories, Pittsburgh, Pa.

The predesign process was implied by Dr. Clarence Zener, acting director of Westinghouse research, who described the qualities of a new alloy.

BIN STUCK LATELY?

It takes a full flow of sand to keep casting production at a high level. When sand chutes like these plug up, production ceases. The molder gets mad, you get mad and your customers get mad.

The installation of Cleveland Vibrators will keep everybody happy. By using Cleveland Vibrators on your bins, hoppers and chutes you eliminate bridging and plugging. Write for complete information and prices.

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CIRCLE NO. 157, PAGE 13-14

Sweden Will Be 1957 Host to International Congress

August 18, 1957 has tentatively been chosen as opening day for the 24th International Foundry Congress to be held in Stockholm. Two general subjects have been chosen for exchange papers. They are ventilation in foundries and testing of cast metal, especially mechanical testing.

Three alternative subjects to receive lesser attention have also been selected. They are (1) modern binders for molds and cores, especially the CO_2 process and resin binders, (2) new developments in melting departments, (3) casting of non-ferrous metals.

Three papers have been requested from the United States, one each on the two major topics and one from an alternate subject.

Sweden will take the main responsibility for arrangements of the congress with cooperation from the associations in Norway, Denmark and Finland. The congress, according to present plans, would be concluded by a trip to the Stockholm archipelago on August 24. Invitations are extended to visit foundries in all Scandinavian countries.

I wish you'd tidy up in here a bit. We're expecting company!

Test Drafting Methods

Simplified drafting has recently been subjected to comparative tests with the standard method by the American Machine & Foundry Co., New York. Its conclusion is that simplified drawing is a supplement and not a replacement for present practices. As a result, the company is issuing free a 56-page booklet on both methods.

VOLCLAY BENTONITE
NEWS LETTER No. 47

REPORTING NEWS AND DEVELOPMENTS IN THE FOUNDRY USE OF BENTONITE

"WHEN ALL IS SAID AND DONE . . .

usually more was said **THAN** *done"*

The above title applies to those foundries that worship high production rates, yet desire closer tolerances and smoother casting finish. Too many foundries strive for high production, sacrificing finish and closer tolerances.

Many foundries are reluctant to use fine sands with green sand molding. However, they are quick to accept fine sands suggested by other molding methods.

Too many foundries use a coarse base sand in the core room and soon lose casting finish in the molding department. An abundance of coarse core sand quickly dilutes a fine molding sand system and the result is **usually poor casting finish.**

Many foundries are reluctant to use a ½" facing sand mixture over a certain pattern, yet they are quite willing to accept a fine, all new, molding sand for another process.

Few foundries divide light from heavy work, yet some new processes are only adapted for castings less than 20 pounds in weight. Many green sand foundries advocate a one base sand system for both light and heavy work.

The facts point toward fine sands as the basis for improved casting finish. Why not use them on green sand light work, if only as facing? There are many excellent fine sands available such as Providence Silica sand, Green Lake Bank No. 115, Larson bank sand, Juniata bank sand, McConnellsville bank sand, Hardy's extra fine bank sand, New Jersey Silica Sand No. 90, and finer, Whitehead's Fine washed Dividing Creek Sand No. 90 to No. 160, Pettinos' No. 111, and many others, too numerous to mention.

By selecting one of the above and using in the following formula, excellent finish can be obtained.

By Weight	
90%	Banks sand AFS Grain Fineness No. 90, or finer
2½%	Volclay western bentonite
2½%	Panther Creek southern bentonite
4%	D Grade Seacoal, or finer
½% – 1%	Carbonized Cellulose

Mix the above formula with 3% moisture content. Riddle over the average production foundry pattern and improved finish can be obtained.

The carbonized cellulose can be obtained from many supply houses under various trade names, such as: "Cellutrol", "Steve-Coal", "Seaflour", and others. These are wood flours that have been carbonized to harmonize with the seacoal or pitch used in the mixture.

Try the above formula on light and medium sized castings, up to 125 pounds. **Improve finish with what you have!**

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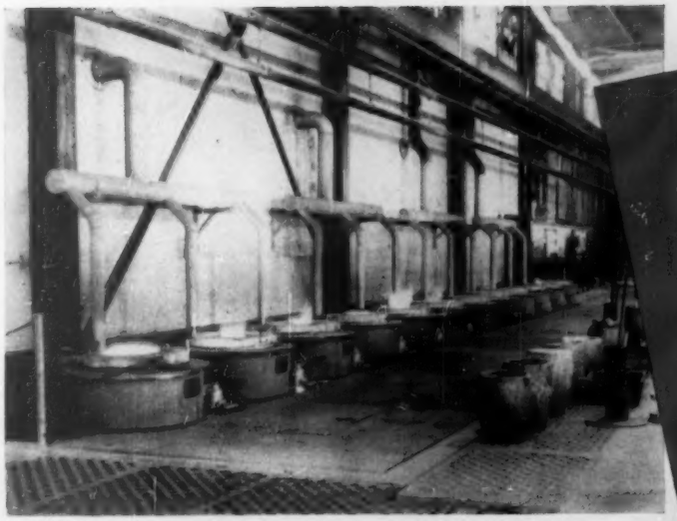
CIRCLE NO. 158, PAGE 13-14



A battery of gas fired, stationary Crucible furnaces at U. S. Naval Gun Factory, Washington, D. C. The pipes manifolded to each set of three furnaces supply air at one pound pressure. Proportional mixers assure constant gas-air ratio set for maximum fuel efficiency and proper furnace atmosphere.

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is best and costs are lowest when CRUCIBLE FURNACES are operated at maximum efficiency

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Have you seen the new " 'CRUCIBLE CHARLIE' says . . ." leaflets issued by Crucible Manufacturers Association? If not, ask your superintendent about this. He has a copy.

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CIRCLE NO. 159, PAGE 13-14

Just Waiting

Some people call us rooters,
Some call us old sand hogs;
To meet production quotas
Will work us all like dogs;
But looking overhead, we find
Our labor's all in vain.
We lose most all the time we've gained
In waiting for the crane.

Before you start in griping
About the awful loss,
I'll tell you how a certain fellow
Got to be a boss.
With a correspondence foundry course,
From Mr. Dave McLain,
He studied all his lessons
While waiting for the crane.

I know a guy who's sick in bed,
For him there ain't much hope;
It seems this yokel wanted
To finish up a cope.
And now he's suffering from shock,
They've gave him up, they say.
'Cause when he hollered, "Looie!"
The crane came right away.

There's lots of things that you can do
Beside just stand and look;
You can nibble on a sandwich,
You can talk or read a book.
And then I know a preacher
Who makes it very plain
That he figures out his sermons
While waiting for the crane.

So if the cranes are tied up,
No use to stand and yell.
Just keep your big fat trap shut,
It'll serve just as well.
You can think of lots of things to do
If you've got half a brain.
I must confess, I wrote this (poem?)
While waiting for the crane.

From *Rammed Up and Poured*, book of foundry poems by Bill Walkins, former sand mill operator, editor of *The ESCO Ladle* of Electric Foundry Co., Portland, Ore.

Italian Magazine Resumes

Publication has been resumed on *Notiziario Olivo*, an Italian foundry magazine which formerly appeared from 1929 to 1931. The magazine is edited by Mario Olivo and published at the main office of the Olivo foundry plants, 18 Fabio Filzi St., Milan, Italy.

Notiziario Olivo accepts contributions and is intended to be a supplement to the technical foundry press. It carries both technical articles and items of general interest. The first publication, April, 1956, has 32 pages with a two-color cover.

patent review

This review inaugurates a series of reports on new patents of interest to foundrymen. Melvin Nord, the author, is a consulting engineer and attorney specializing in patents and inventions. He has a doctor's degree in chemical engineering, is a registered professional engineer and a member of the Michigan and Federal bars.

Removing Castings from Molds

U. S. 2,733,490, issued February 7, 1956 to Charles E. Yates and Calvin D. Pearce, and assigned to International Smelting and Refining Company, describes a device for lowering heavy castings from open molds.

As shown in Fig 1, the water-cooled mold 10 is closed at the bottom by a baseplate 21 which is pivoted so as to be capable of swinging down and away from the mold. As this is done, an elevator platform 37 is inserted below the casting in place of the baseplate 21. The completed operation is shown in Fig 2. Fig 3 shows the elevator mechanism lowered to approximately a horizontal position, with the casting being removed from it by tongs.

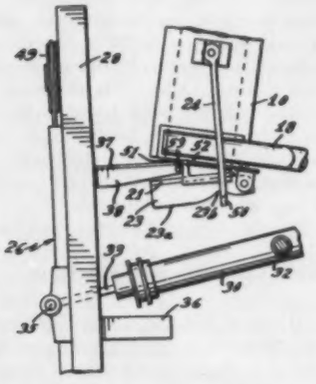

Fig. 1 . . Closing the mold.

According to the inventors, the apparatus has been used satisfactorily in removing 1800-lb copper cakes, 6 ft long, from a water-cooled mold. The surfaces of the cakes were found to be entirely undamaged by the operation. No great skill is required to operate the apparatus and it is sturdy and free from operating diffiulties.

Al-Mg Casting Alloys

U. S. 2,733,991, issued February 7, 1956 to Charles B. Willmore and assigned to William F. Jobbins, Inc., describes new and improved aluminum-magnesium alloys for use in casting.

The casting alloy contains 6.0-8.5 per cent magnesium, 0.10-0.25 per cent titanium, 0.0005-0.03 per cent beryllium for sand castings or 0.001-0.20 per cent for chill castings, and 0.05-0.30 per cent manganese for sand castings or 0.20-0.60 per cent for chill castings.

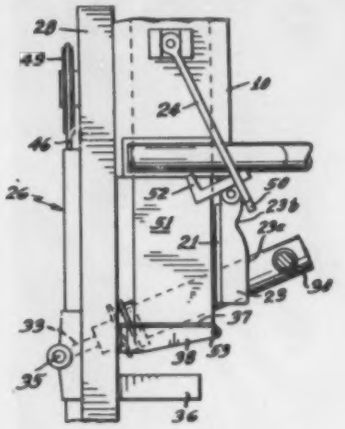

Fig. 2 . . Mold after closing.

According to the inventors the properties thus obtained in the "as cast" condition are comparable to those of heat treatable alloys containing 9-12 per cent magnesium.

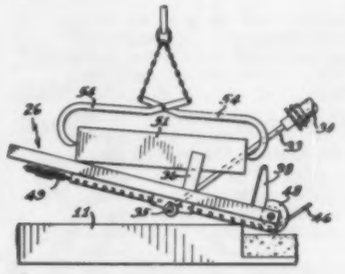

Fig. 3 . . Elevator mechanism.

Melting Stainless Steel in a Reverberatory Furnace

U. S. 2,734,818, issued February 14, 1956 to Carl G. de Laval, Jr.,

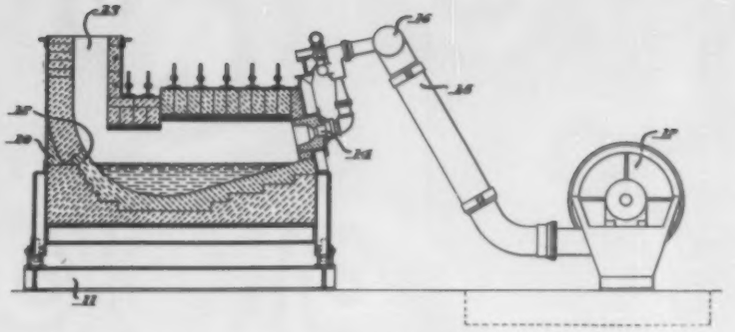

Fig. 4 . . Direct-fired reverberatory furnace for melting stainless steel.

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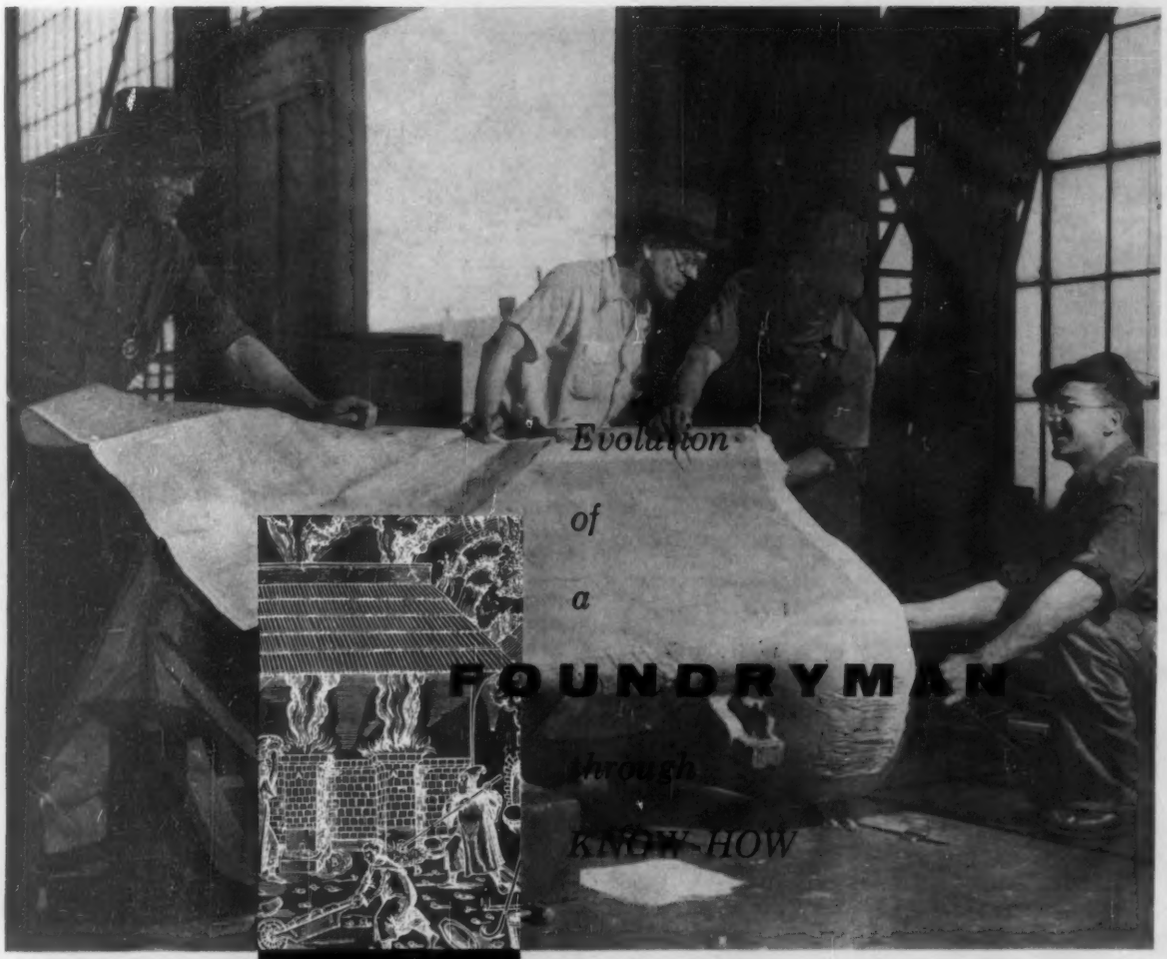

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describes a method for the melting of stainless steel in direct-fired reverberatory furnaces instead of in electric furnaces.

As shown in Fig 4, the reverberatory furnace has a framework 10 tiltably mounted on a base 11 for ease of pouring. Within the furnace framework is constructed a furnace hearth 12 and sidewalls. At one end of the furnace is provided a charging opening 13, and at the opposite end of the furnace is provided a series of burners 14 directed toward the center of the hearth. Combustion air is carried to the burners through a flexible pipe 15 and manifold 16 from a combustion air blower 17.

A furnace of this type was lined with magnesite brick and heated to 3000 F. Two thousand pounds of mixed chromium-nickel scrap was charged, along with ferro-silicon, calcium carbide, limestone, iron ore and fluorspar. After the charge was melted down additional fluorspar and sodium carbonate was added to maintain the resulting slag in the molten condition. Additional calcium carbide was added after the melt-down to reduce substantially all of the chromium oxide formed in the melt-down and which had not been reduced by the action of the ferrosilicon and calcium carbide in the original charge. Iron ore was added to the bath to reduce the carbon to the desired level and to increase slag fluidity and limestone was added to adjust the V-ratio to about 2:1.

Tests showed that the chromium and nickel were retained in the metal without substantial oxidation. The inventor states that this is not the case unless a magnesite brick lining is used and it is at 3000 F. or more before charging and during charging and melting. Also, it is necessary to remove all the slag from each heat so as to start each heat with a clean furnace. Otherwise the steel will lose its chromium content or will produce a slag which is untappable.

Sand Core Dipping Machine

U. S. 2,734,481, issued February 14, 1956 to Bertel Johnson and Willard G. Shaw, assigned to General Motors Corp., describes a machine for dipping core elements in coating materials.

Trays of sand cores are loaded in a rotatable rack and are supported so that a bucket of coating material may be raised to such a position beneath the racks that the core units may be dipped in the coating material without movement of the core units themselves.

obituaries

William Bradford Peirce, 78, formerly vice-president of research and development, Flannery Bolt Co., Bridgeville, Pa., until his retirement in 1947, passed away following a heart attack on July 4.

A member of American Society of Tool Engineers since 1938, Mr. Peirce was elected chairman of the Pittsburgh Chapter in 1940-41. Subsequently he served the Society nationally as chairman of the Membership Committee, a member of the Board of Directors for seven years, as third, second and first vice-president, and in 1947-48 as national president of the Society.

Mr. Peirce was also a member of the Engineer's Society of Western Pennsylvania and the American Society of Mechanical Engineers.

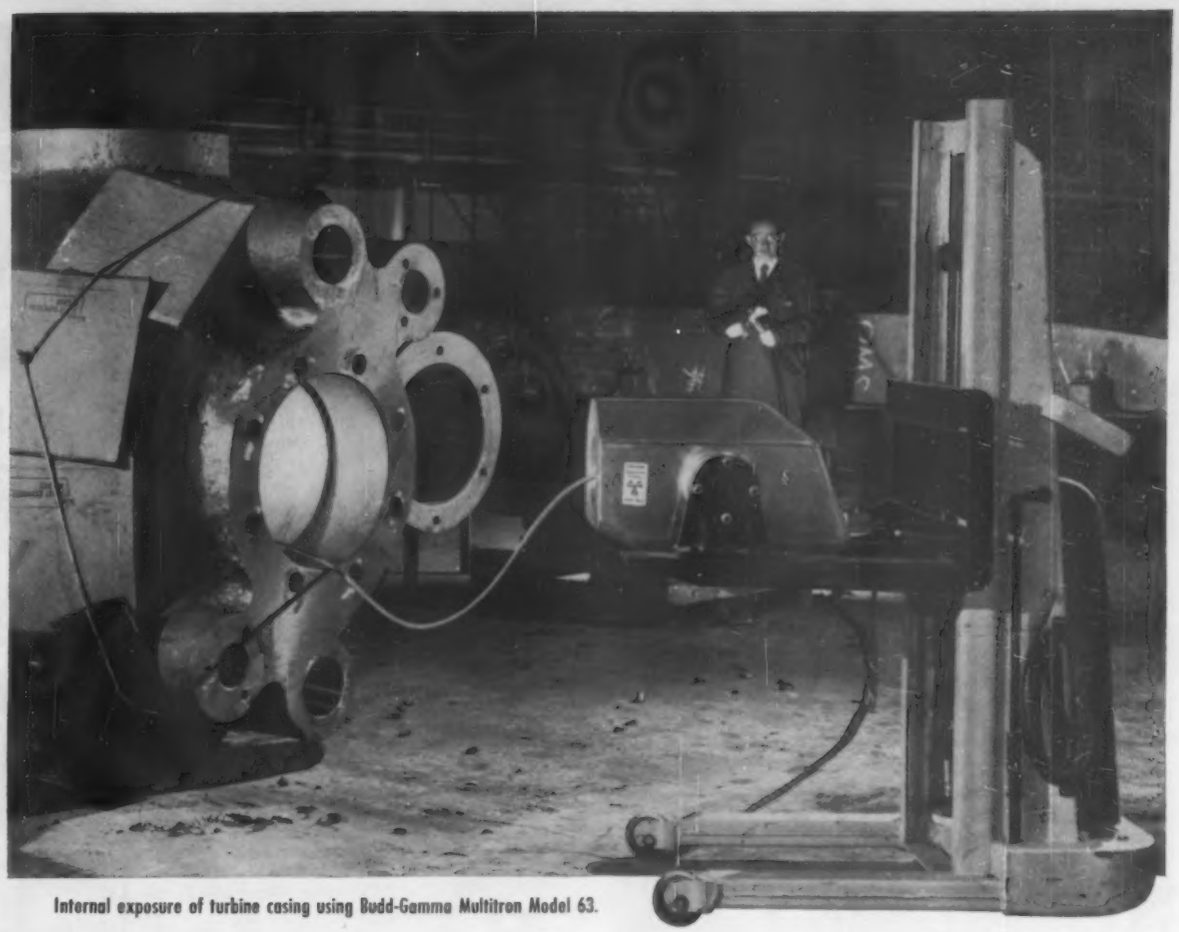
Thomas A. Moormann, manager of the Forging and Casting Plant, Allegheny Ludlum Steel Corp., Ferndale, Mich., died July 5 as a result of injuries sustained from a fall in his home on June 22.

Walter O. Larson, 55, president of Walter O. Larson Foundry Co., Grafton, Ohio, and treasurer of Gray Iron Founders' Society, died July 28 in a Montpelier, Ohio, hospital following an automobile accident while returning from a board of directors meeting of the GIFS at Warsaw, Ind. He had been planning to attend the International Foundry Congress to be held September 1-9 at Dusseldorf, Germany.

Surviving are his wife, two daughters, and a son, Walter O. Larson, Jr., president of Grafton Foundry Co., Grafton, Ohio.

William J. Bartels, assistant treasurer, Erie Malleable Iron Co., Erie, Pa., passed away July 27. He had worked at Erie Malleable since 1907 when he was employed as an office boy. Mr. Bartels was a member of the Northwestern Pennsylvania Chapter of the American Foundrymen's Society.

MORE FACTS on all products, literature, and services shown in the advertisements and listed in Products & Processes and in For the Asking can be obtained by using the handy Reader Service cards, pages 13-14.



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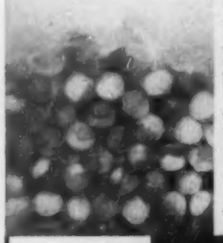

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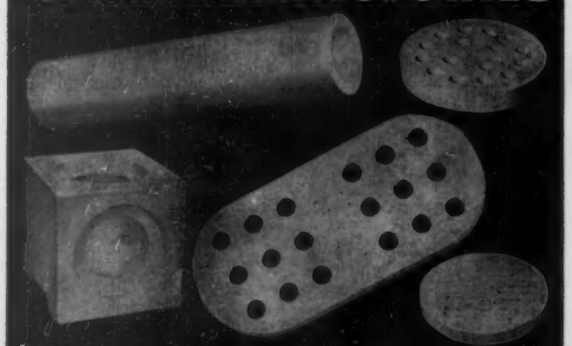

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afs chapter meetings

SEPTEMBER

8 . . Tennessee . . *Camp Columbus, Chattanooga, Tenn. Annual Outing.*

8 . . Central Indiana . . *Lake Shore Country Club, Indianapolis. Annual Picnic.*

11 . . Northern Ill.-Southern Wis. . . *Bel-A-Mar Country Club, Belvidere, Ill. Annual Outing.*

12 . . New England . . *Shahmoon Industries, Inc., Warren Foundry and Pipe Div., Everett, Mass. Plant Visitation.*

13 . . Northeastern Ohio . . *Tudor Arms Hotel, Cleveland. L. P. Robinson, Foundry Div., Archer-Daniels-Midland Co., "Chickens."*

13 . . St. Louis District . . *York Hotel, St. Louis. Dan Chester, Archer-Daniels-Midland Co., "Cold Setting Binders."*

14 . . Tri-State . . *General interest meeting.*

14 . . Mid-South . . *Claridge Hotel, Memphis, Tenn. Edward H. King, Hill & Griffith Co., "Molding Sand and Molding Methods."*

15 . . Corn Belt . . *Lincoln, Nebr. Annual Picnic.*

15 . . Michiana . . *South Shore Inn, Syracuse, Ind. Annual Picnic.*

21 . . Ontario . . *Royal Connaught Hotel, Hamilton, Ontario. Clyde A. Sanders, American Colloid Co., Chicago, "Relative Merits of Sand Casting Techniques."*

28 . . Chesapeake . . *Hotel General Wayne, Waynesboro, Va. Plant visitations during the day and dinner meeting in the evening.*

OCTOBER

1 . . Metropolitan . . *Essex House, Newark, N. J. Ralph Lee, Lee Hobby Foundry, representing General Motors Corp., will speak.*

1 . . Central Indiana . . *Turner's Athenaeum, Indianapolis. Garnet P. Phillips, International Harvester Co., Chicago, "Water Cooled Cupola Operation."*

12 . . Philadelphia . . *Engineers Club, Philadelphia. William B. Coleman Lecture Night.*

12 . . Eastern Canada . . *Sheraton*

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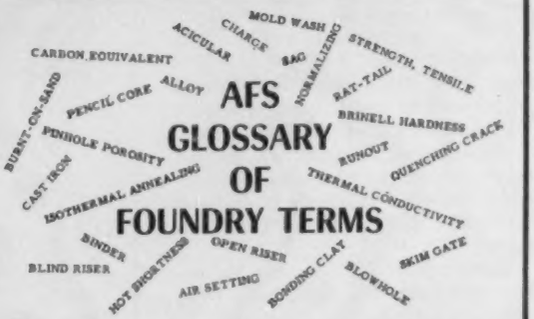

Including almost 2000 terms, this book is intended to help standardize the meanings of foundry terms throughout the metal castings industry. In its preparation, reference was made to many presently existing glossaries and dictionaries of scientific and engineering terms. IT IS THE MOST COMPLETE WORK OF ITS KIND and should be at the finger-tips of every member of the metal castings industry. (80 pp. 6 x 9 Paper Bound.)

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12 . . Mid-South . . *Claridge Hotel, Memphis, Tenn. George E. Miller, Sand Blo Div., Federal Foundry Supply Co., "Core Blowing & Mold Blowing."*

19-20 . . New England . . *Massachusetts Institute of Technology, Cambridge, Mass. New England Regional Foundry Conference.*

28 . . Chesapeake . . *Engineers Club, Baltimore, Md. Clyde A. Sanders, American Colloid Co., Chicago, "What Sand for What Casting."*

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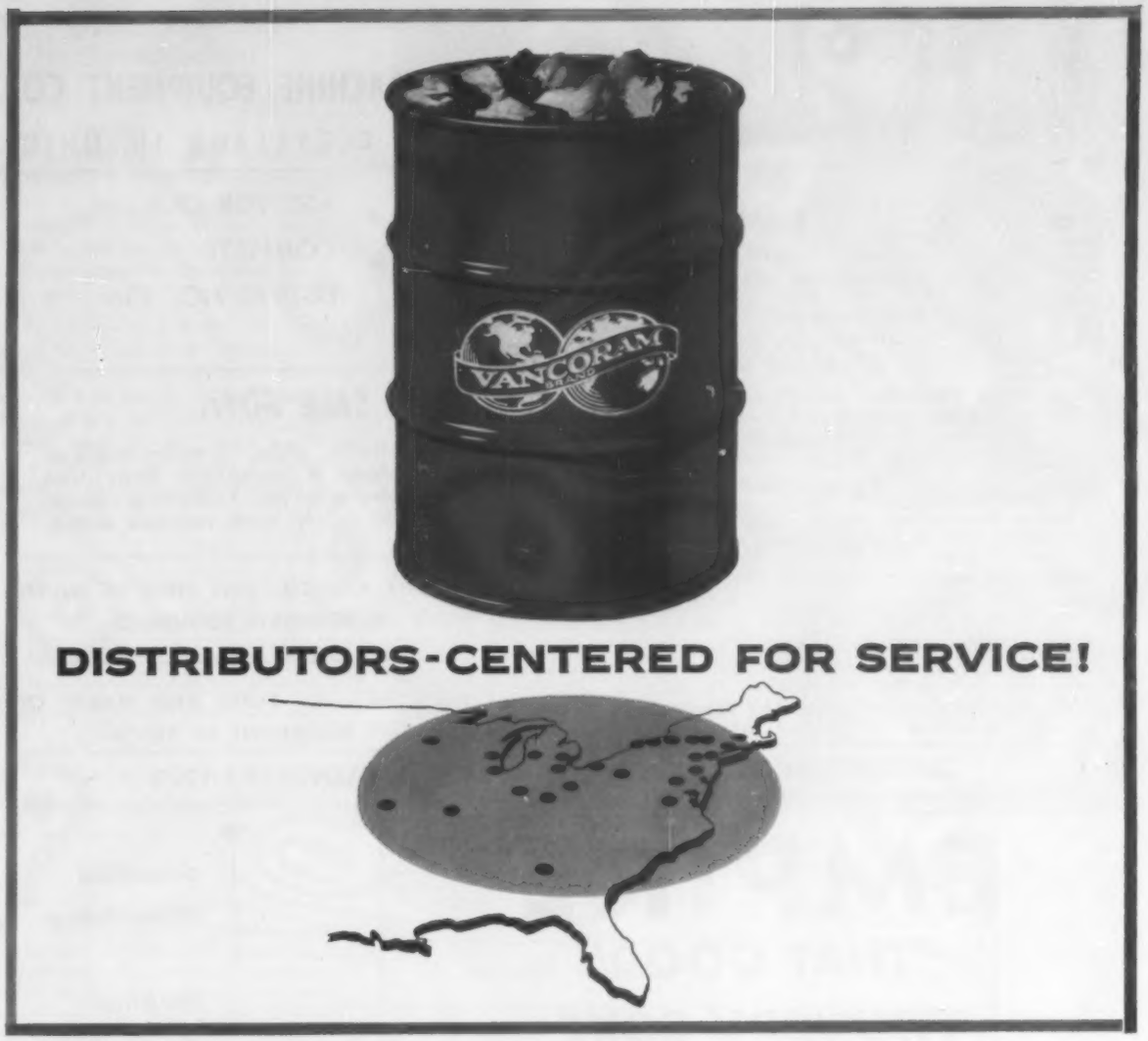

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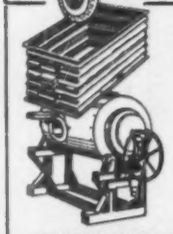

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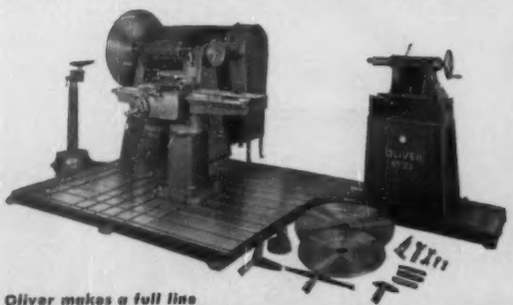

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MOLDERS

A jobbing and captive foundry specializing in producing large and heavy castings has positions available for Coreroom Foreman, Molding Foreman, Coremakers and Molders. A rapidly expanding concern with excellent opportunities for qualifying applicants. Located in the Upper Peninsula of Michigan. Must have experience producing large and heavy castings. Submit qualifications to: **Box C164, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY ENGINEERS Well established metal warehouse, handling foundry alloys has need for salesmen to call on iron and steel foundries in Midwest. Salesmen to work out of Chicago and Milwaukee warehouses. **Address Box C111, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY TECHNICIAN OR CONTROL ENGINEERING ASSISTANT

Mechanized gray iron foundry in Ohio produces quality engineering jobbing castings. Applicant should have some technical background, training or experience in one or more of the following fields—Metallurgy, Cupola Control, Sand Control, Gating and Risering. This position will offer many opportunities in increasing efficiency and control on all foundry operations including practical research, development and application on new foundry processes such as shell process and CO_2 process. Earnings will be dependent on qualifications and ability. **Box C160, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY SUPERINTENDENT

Outstanding opportunity available in Upper New York State for foundry man with several years administrative experience in alloys or stainless operations and capable of supervising foundry engineers. Excellent salary (five figures) and top fringe benefits. Modern plant, growing business, ideal living facilities. Send typed resume and previous earnings to: **Box C167, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

FOUNDRY MANAGER. Outstanding opportunity and challenge with long established New England Gray Iron Jobbing Foundry. We are looking for an exceptional man with a record of real accomplishment who is presently employed but looking for a challenging opportunity. Our man must be a real leader who can demonstrate his ability to handle all foundry responsibilities from purchasing to sales. Reply giving complete details of qualifications, experience and compensation. Information will be regarded as most confidential. **Box C168, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

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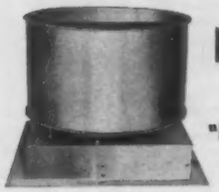

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ASSISTANT FOUNDRY SUPERINTENDENT

We need a man with

— several years experience in methods and techniques of making automotive type castings.

— college education or its equivalent in Metallurgical Engineering.

— practical experience in supervising Foundry operations.

If you are looking for a position which provides the opportunity to grow under the direction of one of the country's leading foremen while working in one of the largest and most modern equipped foundries in the Northwest, please send your resume to: **MR. R. H. CAMPBELL, MINNEAPOLIS-MOLINE COMPANY, BOX 1050 MINNEAPOLIS 1, MINNESOTA.**

EXPERIENCED CLEANING ROOM FOREMAN WANTED. Steel foundry in Milwaukee-Chicago area. Immediate employment. Reply giving detailed experience and references. Salary commensurate with proven ability. **Box C169, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

ONE CLEANING ROOM FOREMAN and ONE MASTER MECHANIC. Central Indiana semi-production gray iron foundry producing castings up to 2 tons requires 2 men who have the desire and ability to grow with an expanding organization. In your reply give complete qualifications to: **Box C162, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

SALES REPRESENTATIVE. Aluminum, Bronze, Magnesium Castings. Should be well versed in foundry practices in Sand, Permanent Mold and Die Casting operations. Develop new territory with good potential. A fine opportunity for a well trained, ambitious person. All replies treated in strict confidence. **OBERDORFER FOUNDRIES, INC., SYRACUSE, N. Y.**

STEEL FOUNDRY GENERAL FOREMAN required by a builder of heavy machinery having large foundry operations in the Montreal area. Output 350 to 700 tons monthly, castings weighing up to 12 tons. Modern foundry. Will be required to assist the superintendent by supervising departmental foremen in the fields of daily operation and handling of working force, production, labor and overhead costs. Incentive plan for working force and foreman. Experience in supervising molding and coremaking operations essential. Must be a potential superintendent and able to organize and train personnel. **Box C161, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

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POSITIONS WANTED

CASTING SALESMAN. N. J. resident familiar sand-shell-investment casting buyers in N.J., N.Y. Technical background. **Box C166, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

METALLURGIST. Graduate Metallurgist, age 35, desires position in production or sales. Six years experience as supervisor in Melting, Heat treating, Core and Foundry Sand Control in production Malleable Foundry. **Box C165, MODERN CASTINGS, Golf and Wolf Roads, Des Plaines, Ill.**

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10 used Heat Treating Furnaces, and two 7-ton gantry cranes, good condition, priced to sell.

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48" Whiting #6 Cupola with 3 ton Crane and Charging bucket, complete with Wilbraham Green rotary pressure blower, size #7, with Westinghouse gear drive motor 125 HP, grids and control panel—2 standard Whiting transfer cars 48" & 60", also Electric towing car and Fairbanks 3000# track type charging scale.

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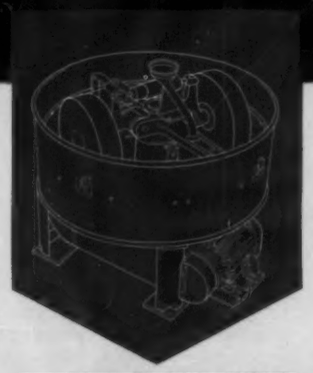
per ton in maintenance that it cost Elyria Foundry Division to run these TWO MIX-MULLERS for a 3½ year period.

The shops that these two 3F Mix-Mullers service pour castings that range from 500 to 100,000 lbs. for the Elyria Foundry Division of Industrial Brownhoist Co., Elyria, Ohio. In the 3½ years since installation they have turned out an impressive 425,000 lbs. of core and backing sand on an 8 and 16 hour a day schedule respectively. They've done it on *pennies per ton* too.

In maintenance these mix-mullers have cost Elyria Foundry Division *one cent per ton* of sand prepared over 3½ years. Including power, the total operating cost figures out at about 4.6 cents per ton. There has been *no* mixer down time in that period. Based on original investment, maintenance, not per year, *but for 3½ years*, has been less than 1%.

It's an impressive record and is in part due to the excellent systematic preventive maintenance program operated by Elyria Foundry Division. But it's typical too of the kind of rugged efficiency which is saving maintenance dollars for Simpson Mix-Muller users the world over.



A MODEL 2F MIX-MULLER
will soon replace the last of Elyria Foundry Division's other mixers to provide them with one of the most modern high capacity sand preparing facilities in the area—all mix-muller equipped!

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NEW PRODUCT IDEAS FOR THE CO_2 PROCESS

A number of proven products for the CO_2 process, that will improve cores and molds, cut costs and promote casting quality are now being manufactured by Stevens.

If you are now using, or are interested in, the latest foundry development, the CO_2 (carbon dioxide) process, write today for the new Stevens Technical Bulletin FA-130,

"STEVENS PRODUCTS FOR THE CO_2 PROCESS."

This bulletin gives complete information on the subject of release agents, core pastes, mudding compounds, core and mold coatings, collapsibility additives and binders for the CO_2 process. Write *FREDERIC B. STEVENS, INC., 1804 Eighteenth Street, Detroit 16, Michigan.*

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FREDERIC B. STEVENS INCORPORATED
EVERYTHING FOR A FOUNDRY
DETROIT 16, MICHIGAN

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nearly anyone can obtain

Cupola Output

but it takes cupola specialists to make operation profitable!

If you are planning the installation of a cupola now or in the near future, or even if you believe your cupola is operating successfully, it will definitely pay you to consider the latest developments that "tailor" the cupola to meet your particular metal requirements. Whiting has made many advancements, not only in cupola design but also in equipment used in conjunction with cupolas, that lead to better metal at lower costs.

In designing and planning a new cupola, for example, the application of scientific principles in construction and arrangement of tuyeres is necessary to provide the proper volume of air to the coke bed. Tons of coke a day can be wasted through mis-use or improper arrangement of tuyeres. Blast, blowers and many other operation factors should be investigated. Fortunately, a great deal can be accomplished with old cupolas. Usually they can be easily modified to incorporate the latest Whiting cupola accessories.

For seventy-two years Whiting has engineered and manufactured cupolas and cupola accessories. Whiting engineering service includes (1) analyses of requirements, (2) layout and selection of equipment, (3) manufacturing supervision, (4) supervision of erection, (5) initial operation, and (6) periodic field checkups. Talk over your plans now with a Whiting engineer!

WHITING CORPORATION, 15628 Lathrop Avenue, Harvey, Illinois

WRITE FOR THESE INFORMATIVE BULLETINS

Here are seven bulletins from Whiting's extensive library on cupola design and operation that will help you in considering improved methods and ways for obtaining maximum output from your cupola. Send for any or all of the bulletins you need—today! When ordering, please specify by "FO" number shown.

FO-2 Tips on improving cupola charging

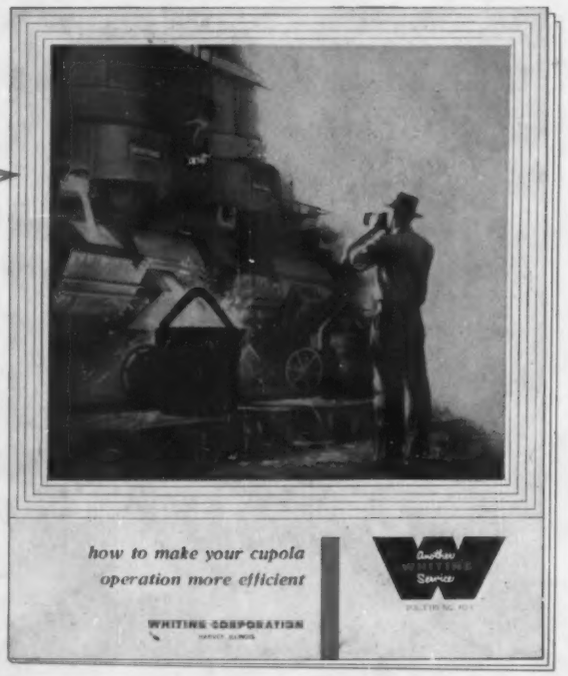
FO-3 Hot-blast

FO-5 Here's how to save melting fuel

FO-7 Cupola blast control

FO-8 Suggestions for solving some cupola operation problems

FO-9 Review of foundry-cupola gasses and temperatures



modern castings